December 1, 2016 • Volume 42-12

CCDR

CANADA COMMUNICABLE DISEASE REPORT

IMPROVING VACCINATION RATES

Editorial

How to improve vaccination rates 243

Overview

Addressing vaccine hesitancy 246

Early Report

A genetic shift in invasive meningococcal disease? 263

News

Candida auris, a globally emerging invasive, multidrug-resistant fungus 267

Public Health Agency of Canada | Agence de la santé publique du Canada

Canada

CCDR
CANADA COMMUNICABLE DISEASE REPORT

The *Canada Communicable Disease Report* (CCDR) is a bilingual, peer-reviewed, open-access, online scientific journal published by the Public Health Agency of Canada (PHAC). It provides timely, authoritative and practical information on infectious diseases to clinicians, public-health professionals, and policy-makers to inform policy, program development and practice.

Editorial Office

Editor-in-Chief
Patricia Huston, MD, MPH

Associate Editor
Hilary Robinson, MB ChB, MSc, FRCPC

Managing Editor
Mylène Poulin, BSc, BA

Production Editor
Wendy Patterson

Editorial Assistant
Jacob Amar

Supplement Editor
Lidiya Tsegaye, RN, MPH (Pending)

Copy Editors
Diane Finkle-Perazzo
Joanna Odrowaz

Photo Credit

Strong superhero child, with drawn muscles. Sunny Studio. http://www.shutterstock.com/pic-223272253/stock-photo-strong-superhero-child-kid-with-drawn-muscles-girl-power-and-feminism-concept.html.

CCDR Editorial Board

Michel Deilgat, CD, MD, MPA, CCPE
Centre for Foodborne, Environmental and Zoonotic Infectious Diseases
Public Health Agency of Canada

Sarah Funnell, MD, CCFP
Resident, Public Health and Preventive Medicine University of Ottawa

Jennifer Geduld, MHSc
Centre for Emergency Preparedness and Response
Public Health Agency of Canada

Judy Greig, RN, BSc, MSc
National Mircrobiology Laboratory
Public Health Agency of Canada

Maurica Maher, MSc, MD, FRCPC
Directorate of Force Health Protection
National Defence

Ryan Regier
Office of the Chief Science Officer
Public Health Agency of Canada

Julie McGihon
Public Health Strategic Communications Directorate
Public Health Agency of Canada

Robert Pless, MD, MSc
Centre for Immunization and Respiratory Infectious Diseases
Public Health Agency of Canada

Hilary Robinson, MB ChB, MSc, FRCPC
Centre for Public Health Infrastructure
Public Health Agency of Canada

Rob Stirling, MD, MSc, MHSc, FRCPC
Centre for Immunization and Respiratory Infectious Diseases
Public Health Agency of Canada

Jun Wu, PhD
Centre for Communicable Diseases and Infection Control
Public Health Agency of Canada

Contact Us

ccdr-rmtc@phac-aspc.gc.ca
613.301.9930

ISSN 1481-8531 Pub.150005

CCDR
CANADA COMMUNICABLE DISEASE REPORT

IMPROVING VACCINATION RATES

INSIDE THIS ISSUE

EDITORIAL

The long and winding road to improving immunization rates: Sharing best practices in Canada 243
MacDonald, NE

OVERVIEW

Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential approaches 246
Dubé E, Bettinger JA, Fisher WA, Naus M, Mahmud SM, Hilderman T

Immunization guidance products: Different levels of detail for different uses 252
Desai S, Tunis M, Stirling R, Jensen C, Ismail S, Baclic O, Lerch R

Updates to the *Canadian Immunization Guide*: April 2015 to October 2016 256
Jensen C, Lerch R on behalf of the National Advisory Committee on Immunization (NACI)

ADVISORY COMMITTEE STATEMENT

Summary of NACI Statement: Immunization Interim Recommendations on the Use of Pneumococcal Vaccines in Immunocompetent Adults 65 Years of Age and Older 260
Quach C, Baclic O on behalf of the National Advisory Committee on Immunization (NACI)

EARLY COMMUNICATION

Invasive serogroup W *Neisseria meningitidis* (MenW) in Ontario, Canada shows potential clonal replacement during the period January 1, 2009 – June 30, 2016 263
Tsang RSW, Deeks SL, Wong K, Marchand-Austin A, Jamieson FB

ID NEWS

Preparedness for Zika Virus Disease — New York City, 2016 267

Candida auris, a globally emerging invasive, multidrug-resistant fungus 267

APPRECIATION 268

EDITORIAL

The long and winding road to improving immunization rates: Sharing best practices in Canada

MacDonald, NE[1*]

Abstract

Vaccines are one of the most effective ways to decrease childhood mortality. Unfortunately, however, Canada placed 28th out of 29 high-income countries in a 2013 UNICEF report that compared national uptake rates of early childhood immunizations. Work is underway to address this issue as reflected in the 2016 federal budget which highlights the importance of improving access to immunization. There are many steps that can be taken to improve vaccine uptake, such as identifying and better understanding the individual and program level factors that underlie delay or refusal to receive vaccines. However, it is challenging to find evidence and ensure its relevancy within the Canadian context. Targeted resources are needed that address the complexity of immunization along the entire continuum from vaccine manufacture through to patient uptake. Although there is a lot of information relevant to Canada, it has not been gathered together in one "go to" site and it is not curated. Canada needs a solid, easily accessible, user-friendly platform for sharing what works in immunization with health care professionals as well as parents and patients. This platform would be a major step in facilitating vaccine acceptance in Canada.

Affiliation

[1] Department of Pediatrics-Infectious Diseases, Faculty of Medicine, Dalhousie University, Halifax, NS

***Correspondence:** nomi.macdonald@dal.ca

Suggested citation: MacDonald, NE. The long and winding road to improving immunization rates: Sharing best practices in Canada. Can Comm Dis Rep. 2016;42(12):243-5.

Introduction

Vaccines are an important tool in decreasing childhood mortality worldwide. They are so important that in 2010, the *Global Vaccine Action Plan* (GVAP), set forth a vision for the Decade of Vaccines to develop a "framework to prevent millions of deaths by 2020 through more equitable access to existing vaccines for people in all communities". This plan was endorsed by the 194 member states of the World Health Assembly (including Canada) in May 2012 (1). Yet, despite the fact that: vaccines have eradicated smallpox, are closing in on polio, have recently been credited with eliminating indigenous measles in the Americas and are supported by a large body of high quality scientific evidence demonstrating the importance of vaccination throughout the life course; immunization of infants, children, adolescents and adults is neither readily accepted nor demanded by all.

Immunization coverage

We are now more than half way through the Decade of Vaccines, yet Canada placed a dismal 28th out of 29 high-income countries in the UNICEF Office of Research's *Innocenti Report 2013* that compared uptake rates of early childhood immunizations country by country (2). Since many provinces and territories lack robust immunization registries, some experts quibble with the Canadian reported rate of 84%, but none would argue that Canada is anywhere near the over 95% rates reported for Finland and several other countries. Strategic Objective 2 of the GVAP states that "individuals and communities understand the value of vaccines and demand immunization as both their right and responsibility" (1). Regardless of whether Canada's early childhood immunization rate was precisely 84% or not, Canada must do better in terms of vaccine acceptance and vaccine demand not just for early childhood vaccines, but also for adolescent and adult vaccination including immunization for pregnant woman. The congenital rubella case reported in Ontario in late 2015 demonstrates that gaps remain in the fetal rubella protection program which can lead to tragic and lifelong consequences (3).

Improving equity of access to immunization was highlighted in Canada's 2016 federal budget which earmarked $25 million over five years, starting in 2016/17 so that "the Public Health Agency of Canada will update the national immunization coverage goals and disease reduction targets, improve Canada's ability to identify under- and un-immunized Canadians, and develop a focused program to improve vaccine access and uptake" (4). The recommendations of the 2015 Vaccine Acceptance and Uptake Working Group provide a road map for PHAC on moving forward to address vaccine hesitancy *(Unpublished data. Dr. Robert Pless, Public Health Agency of Canada).*

Addressing vaccine hesitancy

Vaccine hesitancy, or "the delay in acceptance or refusal of vaccines despite availability of vaccine services," is a well

recognized problem in Canada and globally (5). Unfortunately, ensuring timely acceptance of vaccines is not easy for provincial and territorial immunization programs or front line health care professionals. Simply providing information about the benefits of vaccines and the risks of vaccine preventable diseases is not enough (6,7). Overselling by emphasizing the facts about vaccine benefits and disease risks alone may exacerbate hesitancy and diminish on-time vaccine acceptance (8). The article in this issue by Eve Dubé and colleagues emphasizes the complexity of the vaccine hesitancy problem and offers potential intervention and prevention strategies that may be useful in the Canadian context (9). Sadly, there is no "magic bullet" intervention that will address all concerns about vaccine complacency, convenience and confidence hesitancy such that vaccine acceptance would become the norm for all but the very small minority (likely under one to two percent) who are firm vaccine deniers (8).

As noted by Dubé and others, listening to and determining the factors underlying delay or refusal are critical first steps at the individual and program level (9–11). Communication and intervention strategies must be tailored to address the problem. Specific parental and patient concerns need to be addressed whether they are about vaccine safety, vaccine preventable disease risk, fear of needles or other issues. Since vaccine hesitancy is vaccine specific and varies by context, time and place (8), the list of "new" concerns that pop up may seem endless and daunting, especially for front line workers if the needed evidence is not at their fingertips or is in a format that is not relevant to the hesitant parent or adult patient.

It is often difficult to find evidence quickly and ensure its relevancy in the Canadian context. The article in this issue on the "what, where and for whom" of different National Advisory Committee on Immunization (NACI) products offers helpful tips that will move Canada forward (12). For example, there are detailed evidence-based NACI statements on the PHAC website (13), NACI summaries in the *Canada Communicable Disease Report* such as the annual seasonal influenza vaccine statement (14) and update on hepatitis A (15) as well as practice-oriented immunization information including chapters on each vaccine in the *Canadian Immunization Guide* (16). These are all useful, regularly updated and one can subscribe to automatically receive NACI and CIG updates (17).

Unfortunately, a "what to find where" article is not enough. Targeted resources addressing the complexity of immunization from vaccine manufacturing to patient receipt are needed. Parents/patients have raised concerns at various points along this long continuum from production to the arm. Concerns about vaccine safety are common. These can undermine trust in the system and augment hesitancy to vaccinate. Canada has a very robust vaccine safety system designed to assure high quality and safe vaccines. There is a high quality vaccine delivery system to provide immunization services to patients and a high quality surveillance system to find adverse events following immunization and determine if these are related to the vaccine or the vaccine program and whether action needs to be taken. Indeed, Canada is a leader in vaccine safety. However, many health care professionals are unaware of the robustness and breadth of the vaccine safety system. The Canadian Paediatric Society Committee on Immunization and Infectious Diseases provides a practical overview of Canada's vaccine safety program that can help front line workers better answer vaccine safety system questions raised by parents/patients (18). The importance of the network of special immunization clinics across the country cannot be overstated. These are staffed by pediatric and adult vaccine specialists who are well experienced in addressing challenging adverse events following immunization and who can help assess and counsel those who have had a serious adverse event following immunization.

Accessing best practices

The articles in this issue barely scratch the surface regarding the evidence and information needs of immunization program managers and front line health care workers. While much relevant Canadian information is available, it has not been gathered together in one "go to" site and it is not curated. For example, many front line workers may not be aware of the Canadian Paediatric Society's parental advice on risks and responsibilities of vaccination (19). Similarly, immunization program managers are likely unaware of the recently developed WHO EURO guidance on how to address vocal vaccine deniers in public—a task many find very stressful (20). Even basic awareness of these documents does not make them more accessible on the web. Furthermore, there is no simple way to consult an expert when an immunization conundrum arises. Canada does not have an Immunization Action Coalition like the United States that "works to increase immunization rates and prevent disease by creating and distributing educational materials for health professionals and the public that enhance the delivery of safe and effective immunization services" (21). While Immunize Canada is a beginning, it is neither funded nor equipped to provide the breadth of materials, nor the curating activities and ability to respond to immunization query functions needed in Canada (22).

Conclusion

Canada could be a leader in vaccines rates for children, adolescents, adults and the elderly. We need a more solid, easily accessible, user-friendly platform for health care professionals, parents and patients that will share what works in immunization. Higgledy piggledy information to support a global health priority is not enough. A one-stop platform with useful resources and evidence on best practices would be a major step along the road to supporting improvement in vaccine acceptance in Canada.

Conflict of interest

None.

References

1. World Health Organization (WHO). Global Vaccine Action Plan 2011–2020 [Internet]. Geneva: WHO; 2012 [cited 2016 Oct 24]. Available from: http://www.who.int/immunization/global_vaccine_action_plan/en/.
2. UNICEF Office of Research. Child well-being in rich countries: A comparative overview. Innocenti report card 11 [Internet]. Florence, Italy: UNICEF; 2013 [cited 2016 Oct

24]. Available from: www.unicef-irc.org/publications/pdf/rc11_eng.pdf.

3. Government of Canada. Measles and rubella weekly monitoring report: Week 27, 2016: July 3 – July 9, 2016 [Internet]. Ottawa, ON: PHAC; 2016 [cited 2016 Oct 24]. Available from: http://healthycanadians.gc.ca/publications/diseases-conditions-maladies-affections/measles-rubella-2016-07-surveillance-rougeole-rubeole/index-eng.php.
4. Government of Canada [Internet]. Growing the middle class: Budget 2016. Chapter 5. An inclusive and fair Canada. Ottawa: Government of Canada; 2016 [updated 2016 Mar 22; cited 2016 Oct 24]. Available from: http://www.budget.gc.ca/2016/docs/plan/ch5-en.html.
5. Strategic Advisory Group of Experts on Immunization (SAGE). Report of the SAGE Working Group on Vaccine Hesitancy [Internet]. Geneva: WHO; 2014 [cited 2016 Oct 24]. Available from: www.who.int/immunization/sage/meetings/2014/october/SAGE_working_group_revised_report_vaccine_hesitancy.pdf?ua=1.
6. Jarrett C, Wilson R, O'Leary M, Eckersberger E, Larson HJ and the SAGE Working Group on Vaccine Hesitancy. Strategies for addressing vaccine hesitancy: A systematic review. Vaccine [Internet]. 2015;33(34):4180-90. Available from: http://ac.els-cdn.com/S0264410X15005046/1-s2.0-S0264410X15005046-main.pdf?_tid=12c0d644-8667-11e6-b708-00000aacb35f&acdnat=1475168973_2ff75a5cfd0b5a11b01d61a7669dcda8.
7. Dubé E, Gagnon D, MacDonald NE and the SAGE Working Group on Vaccine Hesitancy. Strategies for addressing vaccine hesitancy: Review of published reviews. Vaccine [Internet]. 2015;33:4191–203. Available from: http://ac.els-cdn.com/S0264410X15005058/1-s2.0-S0264410X15005058-main.pdf?_tid=2fad48be-8667-11e6-b99c-00000aacb361&acdnat=1475169022_993a4854e65a7f9670912ed86d6ac545.
8. MacDonald NE and the SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. Vaccine [Internet]. 2015;33:4161–4. Available from: http://ac.els-cdn.com/S0264410X15005009/1-s2.0-S0264410X15005009-main.pdf?_tid=9bcdbd66-8669-11e6-8a7e-00000aab0f01&acdnat=1475170062_eee93e145066ae4d4979ef4b566dac94.
9. Dubé E, Bettinger JA, Fisher WA, Hilderman T. Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential solutions. Can Comm Dis Rep. 2016;42(12):246-51. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/dr-rm42-12/ar-02-eng.php.
10. Goldstein S, MacDonald NE, Guirguis S and the SAGE Working Group on Vaccine Hesitancy. Health communication and vaccine hesitancy. Vaccine [Internet]. 2015;33:4212–4. Available from: http://ac.els-cdn.com/S0264410X1500506X/1-s2.0-S0264410X1500506X-main.pdf?_tid=48776cda-866c-11e6-8737-00000aacb35f&acdnat=1475171211_466521448f611aeaf4a32a7ff29c90a1.
11. Butler R, MacDonald NE and the SAGE Working Group on Vaccine Hesitancy. Diagnosing the determinants of vaccine hesitancy in specific subgroups: The Guide to Tailoring Immunization Programmes (TIP). Vaccine [Internet]. 2015;33: 4176–9. Available from: http://ac.els-cdn.com/S0264410X15005022/1-s2.0-S0264410X15005022-main.pdf?_tid=335e320c-866c-11e6-b3ba-00000aacb35e&acdnat=1475171175_783d26eb7165aa0b92e6686d404ef8c3.
12. Desai S, Tunis M, Stirling R, Jensen C, Ismail S, Baclic O, Lerch R. Immunization guidance products: Different levels of detail for different uses. Can Comm Dis Rep. 2016;42(12):252-5. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/dr-rm42-12/ar-03-eng.php.
13. Public Health Agency of Canada [Internet]. National Advisory Committee on Immunization (NACI) Recommendations, Statement and Updates. Ottawa: PHAC; 2016 [updated 2016 Oct 17; cited 2016 Oct 24]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/.
14. Gemmill I, Zhao L, Cochrane L. Summary of the National Advisory Committee on Immunization (NACI) Statement on Seasonal Influenza Vaccine for 2016-2017. Can Comm Dis Rep. 2016;42:187-91. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/dr-rm42-9/ar-06-eng.php.
15. Henry B, Baclic O, on behalf of the National Advisory Committee on Immunization (NACI). Summary of the National Advisory Committee on Immunization (NACI) Statement Update on the Recommended Use of Hepatitis A Vaccine. Can Comm Dis Rep. 2016;42:193-4. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/dr-rm42-9/ar-07-eng.php.
16. Public Health Agency of Canada [Internet]. The Canadian Immunization Guide. Ottawa: PHAC; 2016 [updated 2016 Sep 01; cited 2016 Oct 24]. Available from: http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/canadian-immunization-guide-canadien-immunisation/index-eng.php.
17. Government of Canada [Internet]. Canadian Immunization Guide update – Mailing list. [updated 2014 May 13; cited 2016 Oct 24]. Available from: http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/canadian-immunization-guide-canadien-immunisation/email-subscription-abonnement-courriel-eng.php.
18. Canadian Paediatric Society Infectious Diseases and Immunization Committee. Principal authors: MacDonald NE, Law BJ. (November 15, 2016). Canada's eight-component vaccine safety system: A primer for health care workers [Practice Point]. Retrieved from: http://www.cps.ca/en/documents/position/vaccine-safety-system.
19. Canadian Paediatric Society (CPS) [Internet]. Vaccination and your child. Ottawa: CPS; 2016 [updated 2016 Sep; cited 2016 Oct 24]. Available from: http://www.caringforkids.cps.ca/handouts/when-parents-choose-not-to-vaccinate-risks-and-responsibilities.
20. World Health Organization (WHO). Best practice guidance: How to respond to vocal vaccine deniers in public [Internet]. Geneva: WHO; 2016 [cited 2016 Oct 24]. Available from: http://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/publications/2016/best-practice-guidance-how-to-respond-to-vocal-vaccine-deniers-in-public-2016.243-5
21. Immunization Action Coalition [Internet]. Saint Paul, Minnesota: IAC; 2016 [cited 2016 Oct 24]. Available from: http://www.immunize.org/.
22. Immunize Canada [Internet]. Ottawa: CPHA; 2016 [updated 2016 Sep 22; cited 2016 Oct 24]. Available from: http://www.immunize.ca/en/default.aspx.

Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential approaches

Dubé E[1]*, Bettinger JA[2], Fisher WA[3], Naus M[4], Mahmud SM[5], Hilderman T[6]

Abstract

"Vaccine hesitancy" is a concept used frequently in vaccination discourse. This concept challenges previously held perspective that individual vaccination attitudes and behaviours are a simple dichotomy of accept or reject. Given the importance of achieving high vaccine coverage in Canada to avoid vaccine preventable diseases and their consequences, vaccine hesitancy is an important issue that needs to be addressed. This article describes the scope and causes of vaccine hesitancy in Canada and proposes potential approaches to address it.

Affiliations

[1] Institut national de santé publique du Québec, Québec, QC

[2] Vaccine Evaluation Center, BC Children's Hospital, University of British Columbia, Vancouver, BC

[3] Western University, London, ON

[4] BC Centre for Disease Control, Vancouver, BC

[5] Department of Community Health Sciences, University of Manitoba, Winnipeg, MB

[6] Manitoba Health, Winnipeg, MB

Suggested citation: Dubé E, Bettinger JA, Fisher WA, Naus M, Mahmud SM, Hilderman T. Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential approaches. Can Comm Dis Rep. 2016;42(12):246-51.

***Correspondence:** eve.dube@inspq.qc.ca

Introduction

Vaccination is one of the most effective interventions to prevent life threatening communicable diseases (1). Vaccination programs have successfully lowered the prevalence of many infectious diseases and, thus in Canada, poliomyelitis and smallpox have virtually disappeared (2). While the scientific and medical consensus on the benefits of vaccination is clear, an omnipresent negative discourse around the safety and efficacy of vaccines continues to play out in social and traditional media. Because of vaccination success, new generations of Canadians are unaware of the risks of many vaccine preventable diseases and their concerns have shifted to the risks of vaccines (3).

Vaccine hesitancy is a concept that challenges the previously held perspective that vaccination attitudes and behaviours are a simple dichotomy of "accept" or "reject" (4-6). The World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy has defined vaccine hesitancy as a "delay in acceptance or refusal of vaccines despite availability of vaccine services" (7). Vaccine hesitancy is recognized by the WHO as a growing concern worldwide, affecting high, middle and limited resource settings (8). This definition was adapted to the Canadian context based on the opinions of vaccination experts and health professionals. Vaccine hesitancy in Canada has been defined as "reluctance to receive recommended vaccination because of concerns and doubts about vaccines that may or may not lead to delayed vaccination or refusal of one, many or all vaccines" (9). This article describes the scope and causes of vaccine hesitancy in Canada and proposes potential approaches to address this issue.

Prevalence of vaccine hesitancy in Canada

Most Canadian parents choose to provide all recommended vaccines to their children and childhood immunization rates are generally high across Canada (10,11). According to the results of the last Childhood National Immunization Coverage Survey (CNICS), only 1.5% of children in Canada have never received a vaccine (10). However, 70% of the parents surveyed indicated they were concerned about potential side effects from vaccines and 37% believed that a vaccine can cause the same disease it was meant to prevent (10). Results also showed that there is a small proportion of Canadian parents who believe that alternative health practices, such as homeopathy or chiropractic manipulations, can eliminate the need for vaccines (10).

Results of other recent surveys conducted in Canada have also shown that a significant proportion of Canadians hold negative views about vaccination (12-15). Almost one-third of Canadians believe that parents should be able to decide against vaccination; approximately 20% believe that vaccines are directly linked to autism; and significant numbers of Canadians are not convinced of the benefits of herd immunity (the protection of a population against an infectious disease due to a high proportion of the population being vaccinated against it) (12-15). Results of a recent online survey conducted by the Canadian Immunization Research Network (CIRN) indicate that, while only three percent of parents said that their child had not received any vaccines, 19% considered themselves to be vaccine hesitant (*Dubé, E, oral presentation, CIRN Annual Meeting, May 19, 2016*).

Results of another Canadian study indicate that front line vaccine providers believe that vaccine hesitancy is an increasingly prevalent issue in Canada. The surveyed vaccine providers noted that vaccine hesitancy resulted in increased time spent

discussing vaccination issues with concerned patients and extra appointments were needed to accommodate patients who wanted to spread out the vaccines over multiple visits (9).

Important gaps also exist in the understanding of what factors influence vaccine hesitant individuals' decision for or against vaccination. Vaccine uptake does not always equal vaccine acceptance. There are situations where the uptake is high and the acceptance is low; for instance when individuals with concerns about the safety and/or effectiveness of vaccines choose to vaccinate only because of the requirements for school entry. In contrast, there are situations where the uptake is low but not due to vaccine hesitancy, such as when individuals believe in the value of getting vaccinated but do not do so because of logistics and accessibility barriers.

It is difficult to gain a clear picture of the prevalence of vaccine hesitancy among Canadians. Vaccine hesitancy varies across time, place and vaccine (6). There is no standardized tool to measure vaccine hesitancy except for one developed and validated in the United States to predict vaccination decisions of parents of infants based on their attitudes at birth or just after birth (16). In the absence of standardized indicators and without immunization registries (electronic records of all the public health recommended vaccines an individual has received, the age they received them and the specific lot numbers they came from—for safety surveillance reasons and reporting of adverse event following immunization), it is challenging to measure the scope of vaccine hesitancy in Canada. The results of a recent Ontario study that examined trends in medical and nonmedical immunization exemptions to measles containing vaccines have shown that the overall percentage of students with any exemption classification remained low between 2002/03 to 2012/13 (less than 2.5%) (17). However, religious or conscientious exemptions significantly increased during the study period whereas medical exemptions significantly decreased for students between 7–17 years of age, which indicates an increase in vaccine refusals due to vaccine hesitancy (17).

What are the causes?

Vaccine hesitancy is complex and multidimensional. Indeed, there is no single cause of vaccine hesitancy because a mix of different factors is at play. Important drivers of vaccine hesitancy include: concern about the safety of vaccines, perception that vaccines are not beneficial, pain and needle fear or distrust of the pharmaceutical industry in the implementation of vaccination programs (18-20). Negative and false information about vaccination online and in social media is also an important cause of vaccine hesitancy. Indeed, many studies have suggested that the ubiquity of anti-vaccination content on the Internet contributes to an increase in vaccine hesitancy (21-27). Most studies that have examined vaccination related content on websites or social media platforms have shown that the quality of information is highly variable and there is a substantial amount of negative and inaccurate information (26,28-34).

Lack of knowledge about vaccines is frequently identified as a cause of vaccine hesitancy (9,35,36). Studies conducted in different settings, however, have shown that vaccine hesitant parents appear to be well informed individuals who have considerable interest in health related issues and actively seek information (37-39). Indeed, education and socioeconomic status are related to vaccine acceptance, but not in the same way as they are related to health conditions or adherence to public health recommendations. Instead, increased vaccine hesitancy has been associated with both high and low education and high and low socioeconomic status, highlighting the complex array of interrelated factors at play (19).

Many studies have shown that, like most health behaviours, vaccine behaviours are complex and knowledge is only one of many determinants of vaccination decisions (18,35,40). The three Cs model (confidence, complacency and convenience) outlines three key interrelated causes of vaccine hesitancy. Vaccine *confidence* is defined as trust in a) the effectiveness and safety of vaccines; b) the system that delivers them, including the reliability and competence of the health services and health professionals and c) the motivations of the policy-makers who decide which vaccines are needed when and where. Vaccine *complacency* exists where perceived risks of vaccine preventable diseases are low and vaccination is not deemed a necessary preventive action. Complacency about a vaccine or about vaccination in general is influenced by many factors including other life/health responsibilities that may be seen to be more important at that point in time. Vaccine *convenience* is measured by the extent to which physical availability, affordability and willingness to pay, geographical accessibility, ability to understand (language and health literacy) and appeal of immunization services affects uptake. The quality of the service (real and/or perceived) and the degree to which vaccination services are delivered at a time and place and in the cultural context that are convenient and comfortable also affects the decision to be vaccinated (definitions adapted from MacDonald [6]).

What can be done about it?

Because causes of vaccine hesitancy and determinants of vaccine acceptance are complex and multidimensional, there is no "magic bullet" that can address vaccine hesitancy and enhance vaccine acceptance. A summary of the findings from 15 published literature reviews or meta-analysis of the effectiveness of different interventions to reduce vaccine hesitancy and/or to enhance vaccine acceptance reveals that simply communicating evidence about vaccine safety and efficacy to those who are vaccine hesitant has done little to stem the growth of hesitancy related beliefs and fears (41). Furthermore, failure to properly and systematically evaluate the relevance and effectiveness of these interventions across the spectrum of vaccine hesitant individuals and specific vaccines makes it difficult to know whether the results can be transferable or suitable for widespread implementation.

Addressing vaccine hesitancy requires strategies that are: tailored to the concerns of the different segments of the population; based on an empirical understanding of the situation; multi-component; ongoing; and pro-active rather than responsive or reactive (42). Unfortunately, most public health interventions that promote vaccination assume that vaccine hesitancy is due to inadequate knowledge about vaccines (the "knowledge deficit" approach) (35,36). However, as discussed

previously, the situation is complicated and underlying values and priorities compete with public health recommendations (43,44). Changing risk perception (a subjective judgment that people make about the characteristics and severity of a risk) through communication means that messages need to be tailored and targeted to account for the realities of community specific knowledge systems (e.g., adapted to address a vaccine scare peculiar to a specific context or tailored to religious beliefs of a specific community) and the unique information needs and preferences of particular communities (45,46). Successful communication is a "two way process, with an equal measure of listening and telling. Understanding the perspectives of the people for whom immunization services are intended, and their engagement with the issue, is as important as the information that experts want to communicate" (47).

Should the public health community respond to anti-vaccination activists (48)? Leask suggests that adversarial approaches against such activists can in fact enliven the battle and contribute to a false sense that vaccination is a highly contested topic (49). Most of the time, pro-vaccine advocates should "play the issue, not the opponent" (49). Efforts should be made to stop them only when anti-vaccination activists' advice could lead to direct harm.

Future public health vaccine promotion efforts need to embrace Internet and social media possibilities and proactively promote the importance and safety of vaccines rather than adopt a reactive approach to anti-vaccination activists' arguments (47,50,51). The role of social media in vaccine hesitancy creates a need to develop appropriate strategies for online communication. Such strategies should aim to provide vaccine supportive information, address misinformation published online and correspond to parents' needs and interests (29).

Finally, Canadian parents still consider health care providers their most trusted sources of information and advice about vaccination (11,18). Health care providers' recommendations are a major driver of vaccine acceptance (52-54). Risk communication about vaccines can be emotional for both parents and health care providers, especially when ideological positions are not compatible (55). To decrease vaccine hesitancy, health care providers should be well informed and address parents' questions clearly (56). Health care providers should make clear recommendations to vaccinate, but should avoid "overselling" vaccination, as this can also increase hesitancy (57). Research has shown that people are more drawn toward, and are accepting of, information that shares their worldview (58,59). In contrast, when faced with information that contradicts their values, individuals can feel threatened, react defensively and their initial beliefs may become even more strongly held. Messaging that advocates vaccination too strongly may be counterproductive for those who are already hesitant (60,61). Many tools and tips exist to help providers in their discussions with vaccine hesitant or vaccine refusing patients (62-65). While approaches vary, they share common characteristics, such as the importance of maintaining a trustworthy patient provider relationship, as well as tailoring communication to patients' specific concerns and doubts (**Table 1**).

Table 1: Attitudes toward vaccination, with proposed counseling strategies[1]

Vaccine position	Counseling strategies[2]
Vaccine acceptors	• Encourage / promote resiliency. • Explain common side effects and rare adverse events. • Use verbal and numeric descriptions of vaccine and disease risks.
Vaccine hesitant	• Build rapport, accept questions and concerns. • Establish honest dialogue, provide risk and benefit information about vaccines and diseases. • Use decision aids and other quality information tools. • Book another appointment to re-visit discussion, if needed.
Vaccine refusers	• Avoid debating back and forth about vaccination. • Aim to keep discussion brief, but leaving door open to further discussion. • Inform about risks of non vaccination. • Offer attendance at a special clinic[3].

[1] Adapted from Leask (65) and Healy & Pickering (63)
[2] Most strategies are applicable to all groups
[3] Specialists in some countries offer clinics for children who have experienced an adverse event following immunization (66)

Conclusions

Choosing to vaccinate one's child remains the norm in Canada and most parents continue to vaccinate their children. However, clusters of un- or under-vaccinated individuals exist and Canadians are at risk of vaccine preventable diseases, as illustrated by recent outbreaks of measles, mumps and pertussis (67,68). Vaccine hesitancy is an important issue that must be addressed to maintain high vaccine coverage uniformly through the country and lower the incidence and consequences of vaccine preventable diseases.

Understanding the complex mix of factors that determine individual and collective vaccination behaviour is key to designing effective vaccination policies, programs and targeted interventions. Systematic theory-driven research on the determinants of vaccine acceptance and uptake, overall and by vaccine type at the public, provider and system levels are needed to inform policy and interventions. Evaluation research and randomized trials are also needed to assess the effectiveness of interventions, acquire insights on how they work and identify which approaches are most effective for different groups and populations.

Acknowledgements

The authors would like to thank Dominique Gagnon for her help in drafting this paper.

Conflict of interest

None. Dr. Mahmoud reports past research grants from GlaxoSmithKline, Merck, Pfizer and Sanofi Pasteur.

References

1. World Health Organization (WHO). Health Topics Immunization [Internet]. Geneva: WHO; 2016 [cited 2016 Oct 26]. Available from: http://www.who.int/topics/immunization/en/.
2. National Advisory Committee on Immunization (NACI). Canadian immunization guide (evergreen) [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 26]. Available from: http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/canadian-immunization-guide-canadien-immunisation/index-eng.php.
3. Larson HJ, Schulz WS, Tucker JD, Smith DM. Measuring vaccine confidence: introducing a global vaccine confidence index. PLoS Currents. 2015;7.
4. Remes O, Smith LM, Alvarado-Llano BE, Colley L, Levesque LE. Individual- and regional-level determinants of human papillomavirus (HPV) vaccine refusal: the Ontario Grade 8 HPV vaccine cohort study. BMC Public Health. 2014;14:1047.
5. National Vaccine Advisory Committee. Assessing the state of vaccine confidence in the United States: Recommendations from the National Vaccine Advisory Committee. Draft Report Version 2. 2015 [Internet]. Public Health Rep. 2015 Dec;130:572-95. Available from: http://www.hhs.gov/sites/default/files/nvpo/nvac/reports/nvac-vaccine-confidence-public-health-report-2015.pdf.
6. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. Vaccine. 2015;33(34):4161-4.
7. Strategic Advisory Group of Experts on Immunization (SAGE). Report of the SAGE Working Group on Vaccine Hesitancy [Internet]. Geneva: WHO; 2014 [cited 2016 Oct 26]. Available from: www.who.int/immunization/sage/meetings/2014/october/SAGE_working_group_revised_report_vaccine_hesitancy.pdf?ua=1.
8. Dubé E, Gagnon D, Nickels E, Jeram S, Schuster M. Mapping vaccine hesitancy: Country-specific characteristics of a global phenomenon. Vaccine. 2014;32(49):6649-54.
9. Dubé E, Gagnon D, Ouakki M, Bettinger JA, Guay M, Halperin S, et al. Understanding vaccine hesitancy in Canada: Results of a consultation study by the Canadian Immunization Research Network. PLoS One. 2016;11(6):e0156118.
10. Public Health Agency of Canada. Vaccine coverage in Canadian children: Results from the 2013 Childhood National Immunization coverage survey (CNICS) [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 26]. Available from: http://publications.gc.ca/collections/collection_2016/aspc-phac/HP40-156-2016-eng.pdf.
11. Ekos Research Associates Inc. Survey of Parents on Key Issues Related to Immunization [Internet]. Ottawa: EKOS; 2011 [cited 2016 Oct 26]. Available from: http://resources.cpha.ca/immunize.ca/data/1792e.pdf.
12. Mainstreet Technologies. 62% say child care facilities should shun unvaccinated [Internet]. Winnipeg: Scribd: 2015 [cited 2016 Nov 2]. Available from: https://www.scribd.com/doc/255007188/Mainstreet-Technologies-Manitoba-and-Vaccinatons-Poll.
13. Mainstreet Technologies. 66% say child care facilities should shun unvaccinated [Internet]. Winnipeg: Scribd: 2015 [cited 2016 Nov 2]. Available from: https://www.scribd.com/doc/254907012/Mainstreet-Technologies-Saskatchewan-and-Vaccinatons-Poll.
14. Mainstreet Technologies. 65% say child care facilities should shun unvaccinated [Internet]. Winnipeg: Scribd: 2015 [cited 2016 Nov 2]. Available from: https://www.scribd.com/document/254904718/Mainstreet-Technologies-Alberta-and-Vaccinatons-Poll.
15. Mainstreet Technologies. 67% say child care facilities should shun unvaccinated [Internet]. Winnipeg: Scribd: 2015 [cited 2016 Nov 2]. Available from: https://www.scribd.com/document/254901898/Mainstreet-Technologies-Ontario-and-Vaccinatons-Poll.
16. Opel DJ, Taylor JA, Zhou C, Catz S, Myaing M, Mangione-Smith R. The relationship between parent attitudes about childhood vaccines survey scores and future child immunization status: A validation study. JAMA Pediatr. 2013;167(11):1065-71.
17. Wilson SE, Seo CY, Lim GH, Fediurek J, Crowcroft NS, Deeks SL. Trends in medical and nonmedical immunization exemptions to measles-containing vaccine in Ontario: An annual cross-sectional assessment of students from school years 2002/03 to 2012/13. CMAJ Open. 2015;3(3):E317-23.
18. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger JA. Vaccine hesitancy: An overview. Hum Vaccin Immunother. 2013;9(8):1-11.
19. Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007-2012. Vaccine. 2014;32(19):2150-9.
20. Taddio A. Setting the stage for improved practices during vaccine injections: A knowledge synthesis of interventions for the management of pain and fear. Clin J Pain. 2015;31(10 Suppl):S1-2.
21. Kata A. Anti-vaccine activists, Web 2.0 and the postmodern paradigm: An overview of tactics and tropes used online by the anti-vaccination movement. Vaccine. 2012;30(25):3778-89.
22. Betsch C, Brewer NT, Brocard P, Davies P, Gaissmaier W, Haase N, et al. Opportunities and challenges of Web 2.0 for vaccination decisions. Vaccine. 2012;30(25):3727-33.
23. Kennedy A, Lavail K, Nowak G, Basket M, Landry S. Confidence about vaccines in the United States: Understanding parents' perceptions. Health Aff. 2011;30(6):1151-9.
24. Cooper L, Larson H, Katz S. Protecting public trust in immunization. Pediatrics. 2008;122(1):149-53.

25. Fabry P, Gagneur A, Pasquier J. Determinants of A (H1N1) vaccination: Cross-sectional study in a population of pregnant women in Quebec. Vaccine. 2011;29(9):1824-9.
26. Zimmerman R, Wolfe R, Fox D, Fox J, Nowalk M, Troy J, et al. Vaccine criticism on the world wide web. JMIR. 2005;7(2):e17.
27. Salathe M, Khandelwal S. Assessing vaccination sentiments with online social media: Implications for infectious disease dynamics and control. PLoS Comput Biol. 2011;7(10):e1002199.
28. Wolfe R, Sharp L, Lipsky M. Content and design attributes of anti-vaccination web sites. JAMA. 2002;287(24):3245-8.
29. Witteman HO, Zikmund-Fisher BJ. The defining characteristics of web 2.0 and their potential influence in the online vaccination debate. Vaccine. 2012;30(25):3734-40.
30. Davies P, Chapman S, Leask J. Anti-vaccination activists on the world wide web. Arch Dis Child. 2002;87(1):22-5.
31. Scullard P, Peacock C, Davies P. Googling children's health: Reliability of medical advice on the internet. Arch Dis Child. 2010;95(8):580-2.
32. Larson HJ, Smith DM, Paterson P, Cumming M, Eckersberger E, Freifeld CC, et al. Measuring vaccine confidence: Analysis of data obtained by a media surveillance system used to analyse public concerns about vaccines. Lancet Infect Dis. 2013;13(7):606-13.
33. Keelan J, Pavri V, Balakrishnan R, Wilson K. An analysis of the Human Papilloma Virus vaccine debate on MySpace blogs. Vaccine. 2010;28(6):1535-40.
34. Robichaud P, Hawken S, Beard L, Morra D, Tomlinson G, Wilson K, et al. Vaccine-critical videos on YouTube and their impact on medical students' attitudes about seasonal influenza immunization: A pre and post study. Vaccine. 2012;30(25):3763-70.
35. Hobson-West P. Understanding vaccination resistance: Moving beyond risk. Health Risk Soc. 2003;5(3):273-83.
36. Kahan DM. A risky science communication environment for vaccines. Science. 2013;342(6154):53-4.
37. Burton-Jeangros C, Golay M, Sudre P. Compliance and resistance to child vaccination: A study among Swiss mothers. Rev Epidemiol Sante Publique. 2005;53(4):341-50.
38. Cassell JA, Leach M, Poltorak MS, Mercer CH, Iversen A, Fairhead JR. Is the cultural context of MMR rejection a key to an effective public health discourse? Public Health. 2006;120(9):783-94.
39. Guay M, Gallagher F, Petit G, Ménard S, Clément P, Boyer G. Pourquoi les couvertures vaccinales chez les nourrissons de l'Estrie sont-elles sous-optimales? [Internet] Sherbrooke QC: Centre de santé et de services sociaux; 2009 [cited 2016 Oct 26]. Available from: http://www.santeestrie.qc.ca/clients/CIUSSSE-CHUS/professionnels/vaccination/Etude_couvertures_vaccinales__nourrissons_Estrie_2011.pdf.
40. Streefland P, Chowdhury AMR, Ramos-Jimenez P. Patterns of vaccination acceptance. Soc Sci Med. 1999;49(12):1705-16.
41. Dubé E, Gagnon D, MacDonald NE. Strategies intended to address vaccine hesitancy: Review of published reviews. Vaccine. 2015;33(34):4191-203.
42. Butler R, MacDonald NE. Diagnosing the determinants of vaccine hesitancy in specific subgroups: The guide to tailoring immunization programmes (TIP). Vaccine. 2015;33(34):4176-9.
43. Massé R, Desy M. Lay people's interpretation of ethical values related to mass vaccination: The case of A(H1N1) vaccination campaign in the province of Quebec (French Canada). Health Expect. 2014;17(6):876-87.
44. Driedger SM, Cooper E, Jardine C, Furgal C, Bartlett J. Communicating risk to Aboriginal peoples: First Nations and Métis responses to H1N1 risk messages. PLoS One. 2013;8(8):e71106.
45. Gray L, MacDonald C, Mackie B, Paton D, Johnston D, Baker MG. Community responses to communication campaigns for Influenza A (H1N1): A focus group study. BMC Public Health. 2012;12:205.
46. Hutchins SS, Fiscella K, Levine RS, Ompad DC, McDonald M. Protection of racial/ethnic minority populations during an influenza pandemic. Am J Public Health. 2009;99(S2):S261-S70.
47. Goldstein S, MacDonald NE, Guirguis S. Health communication and vaccine hesitancy. Vaccine. 2015;33(34):4212-4.
48. Wilson K, Atkinson K, Deeks S. Opportunities for utilizing new technologies to increase vaccine confidence. Expert Rev Vaccines. 2014;13(8):969-77.
49. Leask J. Should we do battle with anti-vaccination activists? Public Health Res Pract. 2015;25(2):e2521515.
50. Dubé E, Vivion M, MacDonald NE. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: influence, impact and implications. Expert Rev Vaccines. 2014;14(1):99-117.
51. World Health Organization. Global vaccine action plan. Vaccine. 2013;31(S2):B5-B31.
52. Gust DA, Darling N, Kennedy A, Schwartz B. Parents with doubts about vaccines: Which vaccines and reasons why. Pediatrics. 2008;122(4):718-25.
53. Schmitt HJ, Booy R, Aston R, Van Damme P, Schumacher RF, Campins M, et al. How to optimize the coverage rate of infant and adult immunizations in Europe. BMC Med. 2007;5:11.
54. Stefanoff P, Mamelund SE, Robinson M, Netterlid E, Tuells J, Bergsaker MA, et al. Tracking parental attitudes on vaccination across European countries: The Vaccine Safety, Attitudes, Training and Communication Project (VACSATC). Vaccine. 2010;28(35):5731-7.
55. Lyren A, Leonard E. Vaccine refusal: Issues for the primary care physician. Clin Pediatr (Phila). 2006;45(5):399-404.
56. Opel DJ, Heritage J, Taylor JA, Mangione-Smith R, Salas HS, Devere V, et al. The architecture of provider-parent vaccine discussions at health supervision visits. Pediatrics. 2013;132(6):1037-46.
57. Naus M. What do we know about how to improve vaccine uptake? Can Comm Dis Rep. 2015;41(Suppl 3):6-10. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41s-3/com-2-eng.php.

58. Kahan DM, Braman D, Cohen GL, Gastil J, Slovic P. Who fears the HPV vaccine, who doesn't, and why? An experimental study of the mechanisms of cultural cognition. Law Hum Behav. 2010;34(6):501-16.

59. Kahan DM, Jenkins-Smith H, Braman D. Cultural cognition of scientific consensus. J Risk Res. 2011;14(2):147-74.

60. Bloom BR, Marcuse E, Mnookin S. Addressing vaccine hesitancy. Science. 2014;344(6182):339.

61. Nyhan B, Reifler J. Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. Vaccine. 2015;33(3):459-64.

62. Halperin SA. How to manage parents unsure about immunization. Can J CME. 2000;12(1):62-75.

63. Healy CM, Pickering LK. How to communicate with vaccine-hesitant parents. Pediatrics. 2011;127(Supp 1):S127-S33.

64. Opel DJ, Robinson JD, Heritage J, Korfiatis C, Taylor JA, Mangione-Smith R. Characterizing providers' immunization communication practices during health supervision visits with vaccine-hesitant parents: a pilot study. Vaccine. 2012;30(7):1269-75.

65. Leask J, Kinnersley P, Jackson C, Cheater F, Bedford H, Rowles G. Communicating with parents about vaccination: A framework for health professionals. BMC Pediatr. 2012;12:154.

66. Wood N. Immunisation adverse events clinics. N S W Public Health Bull. 2003;14(1-2):25-7.

67. Naus M, Puddicombe D, Murti M, Fung C, Stam R, Loadman S, et al. Outbreak of measles in an unvaccinated population, British Columbia, 2014. Can Comm Dis Rep [Internet]. 2015;41:171-7. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41-07/ar-02-eng.php.

68. Pan-American Health Organization [Internet]. Epidemiological alert. Measles outbreaks and implications for the Americas. New York: PAHO; 9 February 2015 [cited 2016 Oct 26]. Available from: http://www.paho.org/hq/index.php?option=com_content&view=article&id=10405%3A2015-9-february-2015-epidemiological-alert-measles-outbreaks-implications-americas&catid=2103%3Arecent-epidemiological-alerts-updates&Itemid=40266&lang=en.

Public Health Agency of Canada / Agence de la santé publique du Canada

Canada

It only takes 15 minutes per week to help track the spread of influenza-like-illness in Canada.

Seeking:
physicians, nurse practitioners and registered nurses in primary care to become FluWatch sentinel practitioners.

REGISTER TODAY
Send an email to:
fluwatch@phac-aspc.gc.ca

Immunization guidance products: Different levels of detail for different uses

Desai S[1*], Tunis M[1], Stirling R[1], Jensen C[1], Ismail S[1], Baclic O[1], Lerch R[1]

Affiliation

[1] Centre for Immunization and Respiratory Infectious Diseases, Public Health Agency of Canada, Ottawa, ON

***Correspondence:** naci-ccni@phac-aspc.gc.ca

Abstract

The National Advisory Committee on Immunization (NACI) provides expert and evidence-based advice to the Public Health Agency of Canada (PHAC) on the use of human vaccines in Canada. This advice is presented in a variety of publications for different uses. A recent survey identified some confusion regarding the various NACI publication products. The objective of this article is to identify the level of detail and appropriate uses of the different NACI products.

NACI statements provide a synthesis of current evidence and expert opinion on new vaccines or new indications for vaccines to inform immunization practices, policies and programs. NACI literature reviews inform new NACI statements and are published after the statement to inform readers about current literature on a specific immunization topic. The *Canadian Immunization Guide* (CIG) is a practice-oriented guide that synthesizes all the NACI statements and is updated regularly. NACI statement summaries are published in the *Canada Communicable Disease Report* (CCDR) and provide a high level overview of these statements shortly after they are published. These products provide a variety of options for users to choose how in-depth they wish to explore the evidence base and process for producing recommendations for immunization in Canada.

Suggested citation: Desai S, Tunis M, Stirling R, Jensen C, Ismail S, Baclic O, Lerch R. Immunization guidance products: Different levels of detail for different uses. Can Comm Dis Rep. 2016;42(12):252-5.

Introduction

New vaccines and recommendations on the best use of vaccines are being developed on an ongoing basis. Activities related to immunizations are a shared responsibility among the federal, provincial and territorial governments in Canada. The federal government is responsible for the regulation of vaccines, national vaccine safety monitoring, national disease surveillance and provision of expert led immunization advice. The National Advisory Committee on Immunization (NACI) is supported by the Public Health Agency of Canada (PHAC) and has been providing expert and evidence-based advice to the federal government since 1964.

NACI makes recommendations on the use of vaccines currently or newly approved for use in humans in Canada, including the identification of groups at risk for vaccine preventable diseases for whom vaccination should be targeted (1). The Committee reports to the Assistant Deputy Minister of Infectious Disease Prevention and Control Branch of the Public Health Agency of Canada and works with staff of the Centre for Immunization and Respiratory Infectious Diseases at PHAC to provide ongoing medical, scientific and public health advice.

As the field of vaccine research and evidence-based decision making has evolved, NACI's processes and methods have also evolved. For example, when developing new statements, NACI often conducts comprehensive literature reviews to guide the expert advice of the Committee (2).

NACI does more than issue NACI statements. A variety of products have been developed to serve the needs of different audiences, including frontline providers, policy staff and decision-makers at different levels of government and researchers. NACI products include NACI statements, literature reviews, the *Canadian Immunization Guide* (CIG) and NACI summaries in the *Canada Communicable Disease Report* (CCDR).

A recent survey of NACI stakeholders identified that some users find it difficult to identify which NACI product is for whom (*unpublished data*). The objective of this article is to identify the level of detail and appropriate uses of the different NACI products.

Detailed products

NACI statements

NACI statements provide a high level of detail. They are a written record of the evidence that was collated and analysed by the Committee and informed the final recommendations. Statements are written when a new product is introduced, when a new and significant indication is authorized, when new evidence on a vaccine becomes available, or when a new question about the use of a vaccine has been reviewed. For example, NACI was asked to review the use of Hepatitis A for pre exposure immunization. Following review of the data, NACI determined that pre exposure immunization could be safely offered for those six months of age and older (3). Additionally, a statement may be needed if there are significant changes in the

epidemiology of a particular disease or after a new safety signal is detected. For example, after Canadian researchers and others identified a slightly increased risk of febrile seizures following administration of the combined measles, mumps, rubella and varicella vaccine, NACI developed new recommendations to address this (4). Statements include details about the methods that were used to retrieve and review primary literature, as well as a detailed look at the studies and grading of the evidence that informed the recommendations of NACI (5).

The target audience for statements includes those interested in immunization decision making, those designing vaccine programs and other policy-makers. While certainly available to frontline providers and useful to read as a continuing medical education activity, NACI statements offer more detail than is needed to provide immunizations. The types of questions that can be answered from a statement include: What was the evidence that informed these recommendations? What was the quality of this evidence and what role did expert opinion play?

NACI literature reviews

When there is a large volume of evidence on a topic, NACI will often conduct or commission an evidence-based review to synthesize the evidence that will inform their recommendations. Once the research questions have been developed by NACI, literature is collected and appraised according to NACI's published methodology (2). This typically includes a detailed description of the methods used to identify appropriate literature along with an in-depth review and description of that literature. Publishing a literature review separately allows the corresponding statement to be streamlined and concise. These reviews do not provide vaccine recommendations or immunization guidance.

The target audience for these comprehensive reviews is individuals who wish to review all the relevant literature related to a specific question that informed a recommendation by NACI. For example, in 2016 a literature review was published on the topic of high dose seasonal influenza vaccine for adults 65 years and older (6). This review provided the evidence base for the *2016-17 Seasonal Influenza Statement* on the use of high dose trivalent influenza vaccine in adults 65 years of age and older (7). Not all questions reviewed by NACI have a formal literature review published; it depends in part on the amount of evidence that must be reviewed. The decision to publish a literature review separately from the statement is made on a case by case basis.

Summative products

The *Canadian Immunization Guide*

The CIG is the authoritative guide on current NACI immunization recommendations. It began as a small paperback in 1979 (8) and its scope has expanded over time. In 2012-13, the CIG was transformed into an online tool that is now updated regularly to reflect the current state of vaccine knowledge and summarizes the most up-to-date NACI recommendations as well as travel vaccine recommendations from the Committee to Advise on Tropical Medicine and Travel (CATMAT). It includes sections on key immunization information, vaccine safety, vaccination of specific populations, active vaccines and passive immunizations.

Each section of the CIG is reviewed at least once every four years. Alternatively, when a new NACI or CATMAT statement is published with recommendations, changes to the content in the relevant CIG chapters are also made to ensure that the CIG contains the most up-to-date immunization guidance from NACI and CATMAT. These changes are highlighted in the Table of Updates on the CIG website (9) and published annually as a summary in CCDR (10). It is particularly useful when multiple statements have been made on a vaccine. For example, there have been many NACI statements on HPV vaccines over the past decade as the vaccine products and evidence have evolved. The CIG brings together all the current HPV vaccine recommendations and information into one place (11).

The CIG is written in the form of a quick reference guide for frontline immunization providers in Canada. Although routine vaccine schedules may vary among provinces and territories, the CIG provides definitive advice about special populations, travel vaccines, vaccine administration, storage and handling, co-administration of vaccines, passive immunizing agents and more.

NACI summaries in the CCDR

Summaries of NACI statements are published in the CCDR shortly after a new statement is published. They are directed to front line vaccine providers and identify new recommendations and provide a link to the full statement. For example, see the summary in this issue on the interim NACI recommendations for pneumococcal vaccine (12).

Information on all these NACI products is summarized in **Table 1**.

Table 1: An overview of key features of PHAC publications on NACI advice

Product	Features	Details
NACI statements	Designed for	• Informing provincial/territorial vaccine program discussions and decisions. • Providing a synthesis of the evidence informing recommendations and their rationale. • Finding key references to research studies that vaccine recommendations are based on.
	Not designed for	• Finding key information quickly (such as preparation of the vaccine, safety details etc.) to help make decisions when giving vaccines to patients. • Background information about vaccines, vaccine administration and immunological concepts.
	Timelines	• Statements may be updated if: - There is a new product/indication, - There has been a significant change in epidemiology, - New evidence on a vaccine becomes available, - A new question about the use of a vaccine needs to be reviewed, - A new safety question has been identified, OR - There is a vaccine supply issue
	Where to find them	National Advisory Committee on Immunization (NACI) Recommendations, Statements and Updates (http://www.phac-aspc.gc.ca/naci-ccni/index-eng.php)

Table 1 continued

Product	Features	Details
NACI literature reviews	Designed for	• Informing readers about all research on a specific immunization topic that was used in developing recommendations. • Informing provincial/territorial vaccine program discussions and decisions. • Providing a detailed review on a specific research question related to vaccine use.
	Not designed for	• Finding recommendations for a specific vaccine. • Finding information quickly to help make decisions when giving vaccines to patients. • Finding general background information about vaccines, vaccine administration and immunological concepts.
	Timelines	• Not updated. New reviews may be done to inform new statements.
	Where to find them	National Advisory Committee on Immunization (NACI) Recommendations, Statements and Updates (http://www.phac-aspc.gc.ca/naci-ccni/index-eng.php)
Canadian Immunization Guide	Designed for	• Finding key up-to-date information on immunization recommendations for specific vaccine preventable diseases to help make decisions when advising individuals on vaccinations. • Background information about immunology, immunization practices and principles and vaccine administration.
	Not designed for	• Detailed information related to the rationale for recommendations. • Finding references to the research studies that vaccine recommendations are based on. • Epidemiologic reviews of vaccine preventable diseases.
	Timelines	• Each chapter is reviewed - every four years, OR - When a new statement is written.
	Where to find it	Canadian Immunization Guide (http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php)
NACI summaries in the *Canada Communicable Disease Report* (CCDR)	Designed for	• Finding out about new NACI recommendations.
	Not designed for	• Knowing all the evidence base and rationale for the recommendations.
	Timelines	• Available shortly after a new NACI statement is published.
	Where to find them	Canadian Communicable Disease Report (CCDR) (http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/)

Conclusion

New vaccines, research and immunization strategies are being developed all the time to prevent and minimize the effects of infectious diseases, as well as to optimize safety and efficiency of vaccine administration. NACI continues to develop immunization information and guidance products to meet the needs of a diverse readership. Understanding the purpose and content of each product will help public health professionals and clinicians choose the most appropriate product.

Those who are interested can receive ongoing updates of NACI related products by joining the NACI list serve (13). Any questions or comments related to NACI statements, evidence-based reviews and the Canadian Immunization Guide, can be sent through the Contact Us feature on the PHAC website (14).

Acknowledgements

The authors would like to acknowledge the hard work of all NACI members past and present and their commitment to immunization guidance for Canada.

Conflict of interest

None.

Funding

NACI is financially supported by the Public Health Agency of Canada.

References

1. Public Health Agency of Canada. National Advisory Committee on Immunization [Internet]. Ottawa ON: 2016 [updated 2016 Jul 7, cited 2016 July 26]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/.
2. Langley JM. Evidence-based recommendations for immunization: Methods of the National Advisory Committee on Immunization. Can Comm Dis Rep [Internet]. 2009;35(ACS-1):1-10. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/09vol35/acs-1/index-eng.php.
3. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Update on the recommended use of Hepatitis A vaccine [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 24]. Available from: http://www.healthycanadians.gc.ca/publications/healthy-living-vie-saine/hepatitis-a-vaccine-update-recommended-use-2016-mise-a-jour-recommandations-hepatite-a-vaccin/alt/pub-eng.pdf.
4. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Update on Measles-Mumps-Rubella-Varicella Vaccine and Febrile Seizures

[Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct24]. Available from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/vaccine-measles-mumps-rubella-varicella-seizures-2016-vaccin-rougeole-rubeole-oreillons-varicelle-convulsions/alt/pub1-eng.pdf.

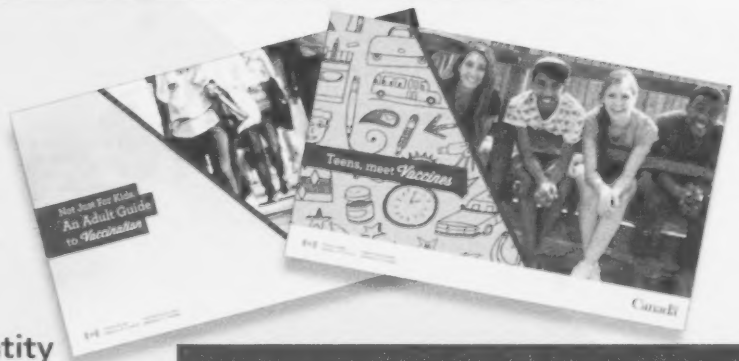
5. Ismail SJ, Langley JM, Harris TM, Warshawsky BF, Desai S, Farhang Mehr M. Canada's National Advisory Committee on Immunization (NACI): Evidence-based decision-making on vaccines and immunization. Vaccine. 2010;28(S):A58-63.
6. Public Health Agency of Canada. A review of the literature of high dose seasonal influenza vaccine for adults 65 years and older [Internet]. Ottawa: PHAC; 2016 [updated 2016 Apr 11, cited 2016 Oct 11]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/influenza-vaccine-65-plus-vaccin-contre-la-grippe-65-plus-eng.php.
7. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Canadian immunization guide chapter on influenza and statement on seasonal influenza vaccine for 2016-2017 [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 11]. Available at: http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-eng.php#v.
8. National Advisory Committee on Immunization (NACI). Canadian immunization guide introduction [Internet]. Ottawa: PHAC; 2014 [cited 2016 Jul 26]. Available from: http://www.phac-aspc.gc.ca/publicat/cig-gci/introduction-eng.php.
9. National Advisory Committee on Immunization (NACI). Canadian immunization guide tables of updates [Internet]. Ottawa: PHAC; 2016 [cited 2016 July 26]. Available from: http://www.phac-aspc.gc.ca/publicat/cig-gci/errata-eng.php.
10. Jensen C, Lerch R on behalf of the National Advisory Committee on Immunization. Updates to the Canadian Immunization Guide: April 2015 to October 2016. Can Comm Dis Rep. 2016;(42)12:256-9. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/dr-rm42-12/ar-04-eng.php.
11. National Advisory Committee on Immunization (NACI). Canadian immunization guide. Part 1: Key immunization information [Internet]. Ottawa: PHAC; 2016 [cited 2016 July 26]. Available from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/4-canadian-immunization-guide-canadien-immunisation/index-eng.php?page=9.
12. Quach C, Baclic O on behalf of the National Advisory Committee on Immunization (NACI). Summary of the NACI interim recommendations on the use of pneumococcal vaccines in immunocompetent adults 65 years of age and older. Can Comm Dis Rep. 2016;42(12): 260-2. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/dr-rm42-12/ar-05-eng.php.
13. Government of Canada [Internet]. Canadian Immunization Guide update – Mailing list. [updated 2014 May 13; cited 2016 Oct 24]. Available from: http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/canadian-immunization-guide-canadien-immunisation/email-subscription-abonnement-courriel-eng.php.
14. Public Health Agency of Canada [Internet]. Contact us. [updated 2016 Aug 11; cited 2016 Oct 24]. Available from: http://www.phac-aspc.gc.ca/contac-eng.php.

THE FACTS ON VACCINES
FOR ADULTS AND TEENS

NEW!

FREE INFO GUIDES AVAILABLE

- Free to order online
- Free shipping
- Available in any quantity
- Available in both official languages



PLACE YOUR ORDER TODAY.
VISIT CANADA.CA/VACCINES

Updates to the *Canadian Immunization Guide*: April 2015 to October 2016

Jensen C[1], Lerch R[1] on behalf of the National Advisory Committee on Immunization (NACI)*

Affiliation

[1] Centre for Immunization and Respiratory Infectious Diseases, Public Health Agency of Canada, Ottawa, ON

***Correspondence:** naci-ccni@phac-aspc.gc.ca

Abstract

The *Canadian Immunization Guide* (CIG) is a trusted, reader-friendly summary of information and advice on immunization that has been used by health care providers and policy makers for decades. It is continuously updated based on new recommendations from the National Advisory Committee on Immunization (NACI) and the Committee to Advise on Tropical Medicine and Travel (CATMAT), two external advisory bodies to the Public Health Agency of Canada. In September 2016, the CIG moved to a new web platform that has improved navigability and is more mobile friendly. Between April 2015 and October 2016, five new NACI statements were published and are reflected in the CIG. The objective of this article is to provide readers with highlights of recent key changes to active vaccine recommendations in the CIG. For example, Hepatitis (HA) vaccine may now be administered to persons six months of age and older and considered for all individuals receiving repeated replacement of plasma-derived clotting factors. There are now new recommendations for the use of HA immunoglobulin post-exposure prophylaxis. For Human papillomavirus (HPV) vaccine, any of the authorized HPV vaccines in Canada, including HPV9 vaccine, can be used according to the recommended HPV immunization schedules. For influenza vaccine, adults with neurologic or neurodevelopment conditions have been added to the group for whom influenza vaccination is particularly recommended, high-dose influenza vaccine has been approved for use in Canada in adults ≥65 years of age and live attenuated influenza vaccine (LAIV) is no longer a preferentially recommended product for use in children and adolescents. On an individual basis, pneumococcal conjugate 13-valent (PNEU-C-13) vaccine may be recommended to immunocompetent adults aged 65 years and older if not previously immunized against pneumococcal disease. When it is given, it should precede the pneumococcal polysaccharide 23-valent (PNEU-P-23) vaccine. Varicella immune globulin may now be administered up to 10 days since last exposure for the purpose of disease attenuation and there were a number of minor changes to the criteria for assessing varicella immunity.

Suggested citation: Jensen C, Lerch R on behalf of the National Advisory Committee on Immunization (NACI). Updates to the *Canadian Immunization Guide*: April 2015 to October 2016. Can Comm Dis Rep. 2016;42(12):256-9.

Introduction

Since 1979, the *Canadian Immunization Guide* (CIG) has provided a trusted, reader-friendly summary of information on immunization and has been used by health care providers who administer vaccines to their patients and by policy makers for the delivery of immunization programs. The CIG, published by the Public Health Agency of Canada (PHAC), translates recommendations and guidance from the National Advisory Committee on Immunization (NACI) and the Committee to Advise on Tropical Medicine and Travel (CATMAT), into a single resource. NACI is a PHAC advisory body that makes recommendations for the use of vaccines currently or newly approved for use in humans in Canada, including the identification of groups at risk for vaccine-preventable diseases for whom vaccination should be targeted (1). CATMAT is an expert advisory body that assists PHAC with travel health-related advice for travellers and health care professionals. Both NACI and CATMAT recommendations are published by PHAC and summarized in the CIG (2).

The CIG is divided into five parts, covering key immunization information, vaccine safety, special populations, active vaccines and passive immunization agents. Part 4 on Active Vaccines, is organized into disease-specific chapters and provides information about disease characteristics and epidemiology, as well as vaccine-specific information and recommendations for use. It is the part of CIG that is most often updated in relation to new recommendations.

The CIG is maintained by NACI. Chapters are updated as new evidence about vaccines and vaccine preventable diseases becomes available and as NACI and CATMAT statements and updates are published. Since 2012, the CIG has been published online in an electronic format (2). A Table of Updates summarizes key changes as they are made to individual chapters. The date on which a chapter has last been reviewed or updated is noted on the respective webpage. In September 2016, the CIG moved to a new web platform and is now mobile friendly with increased navigability for users.

The objective of this article is to provide highlights of recent key changes to active vaccine recommendations in the CIG that have been made since the last CIG update, specifically from April 2015 to October 2016 (3).

Approach

When developing recommendations, NACI conducts comprehensive knowledge syntheses and analyses incorporating scientific reviews, evolving practices and national and international recommendations. The recommendations are then translated into the corresponding chapters of the CIG. Detailed recommendations concerning immunization and the use of vaccines available in Canada can be found in the relevant statements and statement updates (1).

Summary of updates

Table 1 provides a summary of recent changes and additions to the CIG, noting what recommendations are now outdated.

Table 1: Highlights of key changes to active vaccine recommendations in the *Canadian Immunization Guide*, April 2015 to October 2016

Active vaccine	Previous recommendations	New recommendations
Hepatitis A (HA)	Hepatitis A (HA) vaccine may be administered to persons twelve months of age and older.	HA vaccine may be administered to persons six months of age and older (4).
	Immunization with HA vaccine may be considered for people with haemophilia A or B receiving plasma-derived replacement clotting factors.	Immunization with HA vaccine may be considered for all individuals receiving repeated replacement of plasma-derived clotting factors (4).
	No previous recommendation.	For post-exposure prophylaxis within 14 days of exposure of susceptible adults 60 years of age and older who are household or close contacts of a case, standard human immune globulin (Ig) may be provided in addition to HA vaccine (4).
	HA immunization is recommended for persons with chronic liver disease, including those infected with hepatitis C and chronic hepatitis B carriers, because they are at risk of more severe disease if infection occurs.	For post-exposure prophylaxis of susceptible individuals with chronic liver disease, Ig should be provided within 14 days of exposure in addition to HA vaccine (4).
Human papillomavirus (HPV)	Vaccination with HPV2 or HPV4 according to the recommended HPV immunization schedules.	Any of the currently authorized HPV vaccines in Canada, including the recently authorized HPV9 vaccine (Gardasil®9) can be used according to the recommended HPV immunization schedules (5).
Influenza	Influenza vaccine was indicated only for children with neurologic or neurodevelopment conditions.	Adults with neurologic or neurodevelopment conditions have been added to the group for whom influenza vaccination is particularly recommended (6).
	No previous recommendation.	Fluzone® High-Dose influenza vaccine has been approved for use in Canada in adults ≥65 years of age (6). There is evidence that high-dose trivalent inactivated influenza vaccine for older adults should provide superior protection compared with the standard dose intramuscular vaccine.
	Live attenuated influenza vaccine (LAIV) was a preferentially recommended product for use in children and adolescents 2–17 years of age.	LAIV is no longer a preferentially recommended product for use in children and adolescents 2–17 years of age (7).
	Data are not currently available to support the safe administration of LAIV to egg-allergic individuals; therefore, this practice is not currently recommended.	Egg-allergic individuals may be vaccinated against influenza using LAIV (8).
Pneumococcal	No previous recommendation for PNEU-C-13 for immunocompetent adults aged 65 years and older.	On an individual basis, pneumococcal conjugate 13-valent (PNEU-C-13) vaccine may be recommended to immunocompetent adults aged 65 years and older not previously immunized against pneumococcal disease, for the prevention of community acquired pneumonia (CAP) and invasive pneumococcal disease (IPD) caused by the 13 pneumococcal serotypes included in the conjugate vaccine. When it is given, it should precede the pneumococcal polysaccharide 23-valent (PNEU-P-23) vaccine (9).
Varicella	Previous recommendations for minimum intervals were provided for specific products.	Although an interval between two varicella-containing vaccines of at least three months for children less than 13 years of age and six weeks for individuals 13 years of age and older continues to be recommended, a four week interval may be considered in exceptional circumstances. If the second dose of varicella-containing vaccine is administered at an interval of less than four weeks, it should be repeated (10).
	Varicella immune globulin (VarIg) is of maximal benefit if administered within 96 hours after first exposure. If more than 96 hours have elapsed since the last exposure, the benefit of administering VarIg is uncertain.	Varicella immune globulin may be administered up to 10 days since last exposure for the purpose of disease attenuation (11).

In addition to the changes identified in the table for varicella vaccine, further clarification was provided to the criteria for assessing susceptibility for varicella immunity, the use of self-reported history and healthcare provider diagnosis as well as guidance for health care workers, pregnant women and immunocompromised individuals (12).

Conclusion

The CIG is continuously updated to incorporate new science and practices as reflected in the most recent NACI and CATMAT statements and statement updates. PHAC is committed to providing information on immunization and vaccines available for use in Canada in an easily accessible, reader-friendly format, through timely and ongoing CIG updates.

Questions or comments related to the CIG, statements or literature reviews can be directed through the NACI Contact Us feature (13).

To receive information regarding new NACI recommendations, statements and updates and/or updates to CIG chapters, please subscribe to the NACI mailing list (14).

Acknowledgements

The authors would like to thank the extremely dedicated NACI members and the staff of PHAC who support the CIG update process.

Conflict of interest

None.

Funding

PHAC supports the activities of NACI as an external advisory body.

References

1. National Advisory Committee on Immunization (NACI) [Internet]. NACI statements, recommendations and updates. Ottawa: PHAC; 2016 [updated 2016 Oct 17; cited 2016 Oct 12]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/index-eng.php#rec.
2. National Advisory Committee on Immunization (NACI). Canadian immunization guide [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/canadian-immunization-guide-canadien-immunisation/index-eng.php.
3. Gemmill I, Quach C on behalf of the National Advisory Committee on Immunization (NACI). Updates to the Canadian Immunization Guide: March 2014 to March 2015 [Internet]. Can Comm Dis Rep. 2015 Apr;41(S3). Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41s-3/updates-mj04-eng.php.
4. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Update on the recommended use of Hepatitis A vaccine [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://www.healthycanadians.gc.ca/publications/healthy-living-vie-saine/hepatitis-a-vaccine-update-recommended-use-2016-mise-a-jour-recommandations-hepatite-a-vaccin/index-eng.php.
5. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Updated recommendations on human papillomavirus (HPV) vaccines: 9-valent HPV vaccine and clarification of minimum intervals between doses in the HPV immunization schedule [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://www.healthycanadians.gc.ca/publications/healthy-living-vie-saine/human-papillomavirus-9-valent-vaccine-update-recommendation-mises-a-jour-recommandations-papillome-humain-vaccin-nonavalent/index-eng.php?_ga=1.177483553.56611766.1473697342.
6. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Canadian immunization guide chapter on influenza and statement on seasonal influenza vaccine for 2016-2017 [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-eng.php.
7. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Addendum – LAIV use in children and adolescents. Canadian immunization guide chapter on influenza and statement on seasonal influenza vaccine for 2016-2017 [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-addendum-children-enfants-eng.php.
8. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Addendum – LAIV use in egg allergic individuals. Canadian immunization guide chapter on influenza and statement on seasonal influenza vaccine for 2016-2017 [Internet] Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://www.phac-aspc.gc.ca/naci-ccni/flu-2016-grippe-addendum-eggs-oeufs-eng.php.
9. National Advisory Committee on Immunization (NACI). Canadian immunization guide. Varicella vaccine chapter [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/4-canadian-immunization-guide-canadien-immunisation/index-eng.php?page=24.
10. Advisory Committee Statements (ACS) National Advisory Committee on Immunization (NACI). Update on the use of 13-valent pneumococcal conjugate vaccine (PNEU-C-13) in addition to 23-valent pneumococcal polysaccharide vaccine (PNEU-P-23) in immunocompetent adults 65 years of age and older - Interim recommendation [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 17]. Available from: http://www.healthycanadians.gc.ca/publications/healthy-living-vie-saine/update-pneu-c-13-and-pneu-p-23-mise-a-jour-2016/index-eng.php.

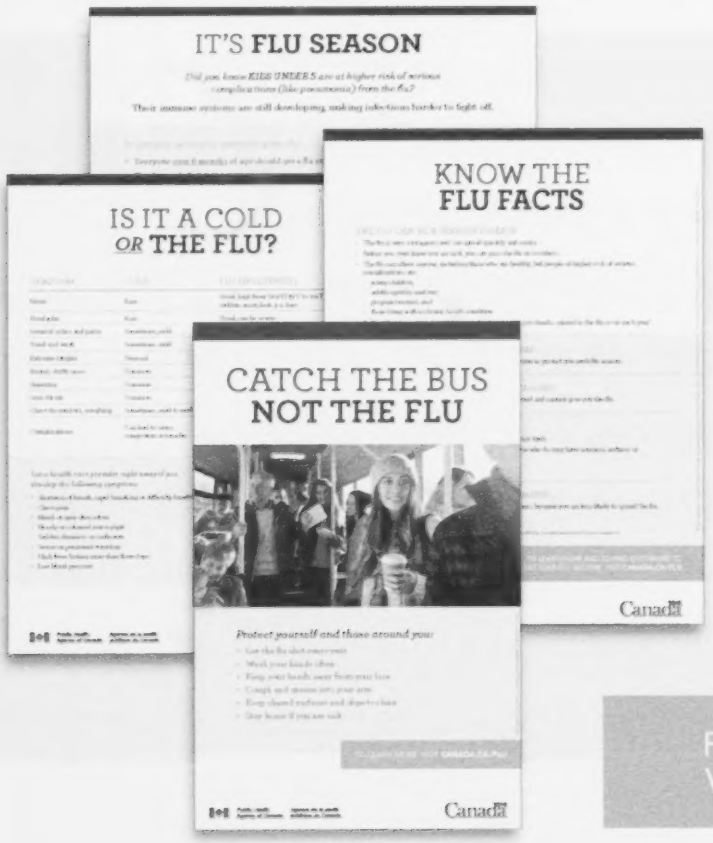
11. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Updated recommendations for the use of varicella zoster immune globulin (VarIg) for the prevention of varicella in at-risk patients [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/varicella-recommended-use-risk-patients-2016-recommandations-varicelle-patients-risque/index-eng.php.

12. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Varicella proof of immunity- 2015 update [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 12]. Available from: http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/varicella-proof-immunity-2015-varicelle-preuve-immunite/index-eng.php.

13. Public Health Agency of Canada [Internet]. Contact us. [updated 2016 Aug 11; cited 2016 Oct 24]. Available from: http://www.phac-aspc.gc.ca/contac-eng.php.

14. Government of Canada [Internet]. Canadian Immunization Guide update – Mailing list. [updated 2014 May 13; cited 2016 Oct 24]. Available from: http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/canadian-immunization-guide-canadien-immunisation/email-subscription-abonnement-courriel-eng.php.

SPREAD THE WORD
ABOUT THE FLU



POSTERS, PAMPHLETS, POSTCARDS AND MORE.

+ Free to order online
+ Free shipping
+ Available in any quantity
+ Available in both official languages

PLACE YOUR ORDER TODAY.
VISIT CANADA.CA/FLU

Summary of NACI Statement: Interim Recommendations on the Use of Pneumococcal Vaccines in Immunocompetent Adults 65 Years of Age and Older

Quach C[1], Baclic O[2] on behalf of the National Advisory Committee on Immunization (NACI)*

Affiliations

[1] NACI Pneumococcal Working Group Chair, Montréal, QC

[2] Centre for Immunization and Respiratory Infectious Diseases, Ottawa, ON

***Correspondence:** naci-ccni@phac-aspc.gc.ca

Abstract

Background: Since 2015, pneumococcal 13-valent conjugate vaccine (PNEU-C-13) has been authorized for the prevention of invasive pneumococcal disease (IPD) and pneumococcal community-acquired pneumonia (CAP) in adults. Adults with immunocompromising conditions are still recommended to receive PNEU-C-13 followed by the pneumococcal 23-valent polysaccharide vaccine (PNEU-P-23). National Advisory Committee on Immunization (NACI) guidance has been requested on the use of PNEU-C-13 vaccine in immunocompetent adults 65 years of age and older.

Objectives: To make recommendations, at the individual level, for the use of PNEU-C-13 in immunocompetent adults 65 years of age and over.

Methods: The NACI Pneumococcal Working Group (PWG) reviewed key questions and performed an evidence review and synthesis. In consideration of the burden of illness to be prevented, the target population, safety, immunogenicity, efficacy and effectiveness of the vaccine, the PWG proposed recommendations for vaccine use to NACI. All evidence was rated and reported in evidence tables. NACI approved specific evidence-based recommendations and elucidated the rationale and relevant considerations in the statement update.

Results: NACI identified and reviewed evidence from one randomized controlled trial investigating the efficacy of PNEU-C-13 to prevent IPD and CAP in adults who were immunocompetent at enrollment and three clinical trials assessing the immunogenicity in immunocompetent and immunocompromised adults.

Conclusions: Based on reviewed evidence, NACI issued new recommendations for the use of pneumococcal vaccines in immunocompetent adults 65 years of age and older.

Suggested citation: Quach C, Baclic O on behalf of the National Advisory Committee on Immunization (NACI). Summary of NACI Statement: Interim Recommendations on the Use of Pneumococcal Vaccines in Immunocompetent Adults 65 Years of Age and Older. Can Comm Dis Rep. 2016;42(12):260-2.

Introduction

Infections caused by *Streptococcus pneumoniae* are a major cause of morbidity and mortality worldwide. In Canada, the burden of disease is highest in young children and older adults (1).

Since January 2012, pneumococcal 13-valent conjugate vaccine (PNEU-C-13) has been authorized for use in adults 50 years of age and older for the prevention of invasive pneumococcal disease (IPD) caused by *S. pneumoniae* serotypes included in the vaccine (2). Since 2013, the National Advisory Committee on Immunization (NACI) has recommended the use of PNEU-C-13 vaccine, followed by the pneumococcal 23-valent polysaccharide vaccine (PNEU-P-23), in adults with immunocompromising conditions (3). Following the approval of an expanded adult indication of PNEU-C-13 vaccine for the prevention of pneumococcal community-acquired pneumonia (CAP) in 2015 (4), NACI was requested to provide additional guidance on its use in immunocompetent adults 65 years of age and older.

Methods

The NACI Pneumococcal Working Group (PWG) reviewed key questions and performed an evidence review and synthesis. In consideration of the burden of illness to be prevented, the target population, safety, immunogenicity, efficacy and effectiveness of the vaccine, the PWG proposed recommendations for vaccine use to NACI. All evidence was rated and reported in evidence tables. NACI approved specific evidence-based

recommendations and elucidated the rationale and relevant considerations in the statement update.

Results

PWG and NACI reviewed evidence from four trials for the efficacy of PNEU-C-13 vaccine. No studies on the effectiveness of PNEU-C-13 vaccine were identified through the literature search. Efficacy data of PNEU-C-13 to prevent IPD and CAP in adults who were immunocompetent at enrollment were reported in one trial (5) and three trials provided data on vaccine immunogenicity in immunocompetent and immunocompromised adults (6-8).

Conclusion

Based on reviewed evidence, NACI issued two recommendations for the use of pneumococcal vaccines in immunocompetent adults 65 years of age and older.

Recommendation 1:

NACI concludes that there is good evidence, on an **individual** basis, to recommend in **immunocompetent adults aged 65 years and older not previously immunized against pneumococcal disease,** the use of PNEU-C-13 vaccine followed by PNEU-P-23, for the prevention of CAP and IPD caused by the 13 pneumococcal serotypes included in the conjugate vaccine. (*NACI Recommendation Grade A*).

In immunocompetent adults aged 65 years and older, PNEU-C-13 vaccine has been shown to be safe and moderately efficacious against CAP and IPD caused by the 13 serotypes included in the vaccine. There are no effectiveness studies on PNEU-C-13 in adult populations. In clinical trials, local adverse events such as injection site pain and systemic adverse events, such as fatigue and newly occurring generalized pain were common but overall mild.

If immunization with PNEU-C-13 vaccine is being considered, pneumococcal vaccine-naïve individuals should first receive PNEU-C-13 vaccine, followed by PNEU-P-23 vaccine at least 8 weeks later. The purpose of administering PNEU-P-23 to an individual who has already received PNEU-C-13 is to expand the breadth of serotypes against which an individual is protected. For immunization of individuals who have previously received PNEU-P-23 vaccine, NACI recommends administration of PNEU-C-13 at least one year after any previous dose of PNEU-P-23 vaccine, due to the theoretical potential for decrease in antibody titers following immunization with PNEU-P-23 vaccine.

Recommendation 2:

NACI concludes that, based on circulating serotypes, there is fair evidence to recommend the use of PNEU-P-23 vaccine in **routine immunization programs** for adults aged 65 years and older. (*NACI Recommendation Grade B*)

Because the burden of pneumococcal disease caused by serotypes included in the PNEU-P-23 vaccine, but not contained in the PNEU-C-13 vaccine remains significant, NACI continues to recommend the administration of PNEU-P-23 for all adults 65 years of age and older who have not received either vaccine previously. PNEU-C-13 vaccine effectiveness is dependent on the circulation of vaccine specific serotypes. Comparative immunogenicity studies between PNEU-C-13 and PNEU-P-23 indicate that Geometric Mean Titres (GMTs) are higher in elderly subjects vaccinated with PNEU-C-13 for eight serotypes that are common to both vaccines, but the clinical and population-level implications associated with this improved immunogenicity remains unclear. No additional booster dose of PNEU-P-23 vaccine is currently recommended for those over the age of 65 years who do not have other underlying medical conditions that would put them at higher risk for IPD or severe CAP.

A complete review of evidence and full NACI recommendations on the use of pneumococcal vaccine are published in the NACI statement update (9) and the pneumococcal vaccine chapter of the *Canadian Immunization Guide* (10). Recommendations that consider other public health aspects of pneumococcal immunization will be addressed in a forthcoming NACI statement.

Acknowledgements

NACI Members: Gemmill I (Chair), Quach C (Vice-Chair), Dayneka N, Deeks S, Henry B, Marchant-Short S, Salvadori M, Sicard N, Vaudry W, Vinh D, Warrington R

Liaison Representatives: Blake J (Society of Obstetricians and Gynaecologists of Canada), Brophy J (Canadian Association for Immunization Research and Evaluation), Cohn A (Centers for Disease Control and Prevention, United States), Emili J (College of Family Physicians of Canada), Lavoie M (Council of Chief Medical Officers of Health), Mah C (Canadian Public Health Association), Moore D (Canadian Paediatric Society), Pham-Huy A (Association of Medical Microbiology and Infectious Disease Canada), Sartison E (Canadian Immunization Committee)

Ex-Officio Representatives: Barnes K (National Defence and the Canadian Armed Forces), Charos G (Centre for Immunization and Respiratory Infectious Diseases [CIRID], Public Health Agency of Canada [PHAC]), Coleman G (Biologics and Genetic Therapies Directorate, Health Canada [HC]), Gallivan J (Marketed Health Products Directorate [MHPD], HC), Pennock J (CIRID, PHAC), Wong T (First Nations and Inuit Health Branch [FNIHB], HC)

This statement was prepared by the Pneumococcal Working Group: Quach C (Chair), DeWals P, Fisman D, Johnstone J, Kellner J, McNeil S, Rechner S, Tyrrell G.

NACI acknowledges and appreciates the contribution of Oliver Baclic, Christina Jensen, Lindsey Sherrard and Nicholas Winters to the statement.

Funding

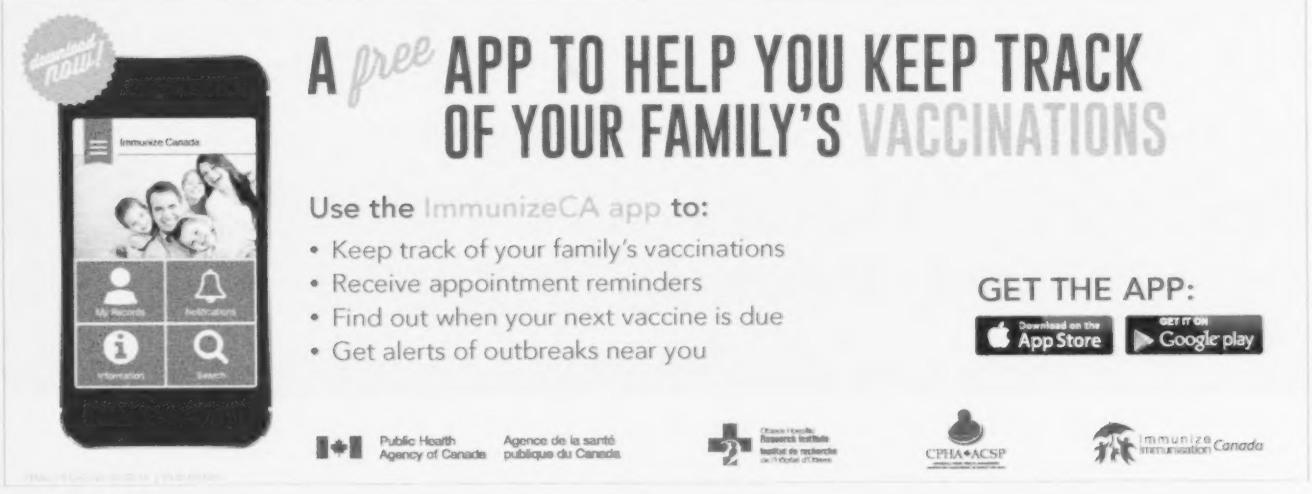
The work of NACI is supported by the Public Health Agency of Canada.

Conflict of interest

None.

References

1. Public Health Agency of Canada (PHAC). Invasive pneumococcal disease [Internet]. Ottawa ON: PHAC; 2016. [updated 2016 Mar 10; cited 2016 Aug 11]. Available from: http://www.phac-aspc.gc.ca/im/vpd-mev/pneumococcal-pneumococcie/professionals-professionnels-eng.php.
2. Pfizer Canada. Health Canada approves extended use of Prevnar® 13 in adults 50 years and older. Canada Newswire. 2015 Feb 15. Available from: http://www.newswire.ca/news-releases/health-canada-approves-extended-use-of-prevnar-13-in-adults-50-years-and-older-509639921.html.
3. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Statement on the use of conjugate pneumococcal vaccine – 13 valent in adults (Pneu-C-13). Ottawa ON: PHAC; 2013. [updated 2013 Oct 30; cited 2016 Aug 11]. Can Comm Dis Rep [Internet]. 2013;39(ACS5):3-50 Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/13vol39/acs-dcc-5/index-eng.php.
4. Pfizer Canada. Prevnar® 13 now approved in Canada for the prevention of vaccine-type pneumococcal pneumonia in adults 18 years of age and older. Canada Newswire. 2015 Aug 5. 2015. Available from: http://www.newswire.ca/news-releases/prevnar-13-now-approved-in-canada-for-the-prevention-of-vaccine-type-pneumococcal-pneumonia-in-adults-18-years-of-age-and-older-520737471.html.
5. Bonten MJM, Huijts SM, Bolkenbaas M, et al. Polysaccharide conjugate vaccine against pneumococcal pneumonia in adults. N Engl J Med 2015;372:1114–1125.
6. Tinoco JC, Juergens C, Ruiz Palacios GM, et al. Open-label trial of immunogenicity and safety of a 13-valent pneumococcal conjugate vaccine in adults ≥50 years of age in Mexico. Clin Vaccine Immunol 2015;22(2):185-92.
7. Jackson LA, Gurtman A, van Cleeff M, et al. Immunogenicity and safety of a 13-valent pneumococcal conjugate vaccine compared to a 23-valent pneumococcal polysaccharide vaccine in pneumococcal vaccine-naive adults. Vaccine 2013;31(35):3577-84.
8. Glesby MJ, Watson W, Brinson C, et al. Immunogenicity and safety of 13-valent pneumococcal conjugate vaccine in HIV-infected adults previously vaccinated w1ith pneumococcal polysaccharide vaccine. J Infect Dis 2015;212(1):18-27.
9. Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Update on the use of 13-valent pneumococcal conjugate vaccine (PNEU-C-13) in addition to 23-valent pneumococcal polysaccharide vaccine (PNEU-P-23) in immunocompetent adults 65 years of age and older - Interim recommendation [Internet]. Ottawa: PHAC; 2016 [cited 2016 Oct 17]. Available from: http://www.healthycanadians.gc.ca/publications/healthy-living-vie-saine/update-pneu-c-13-and-pneu-p-23-mise-a-jour-2016/index-eng.php.
10. National Advisory Committee on Immunization (NACI). Canadian immunization guide, Part 4, Active vaccines, pneumococcal vaccine [Internet]. Ottawa ON: PHAC; 2015. [updated 2015 Mar 24; cited 2016 Aug 11]. Available from: http://www.phac-aspc.gc.ca/publicat/cig-gci/p04-pneu-eng.php.


download now!
Immunize Canada
My Records
Notifications
Information
Search
A free APP TO HELP YOU KEEP TRACK OF YOUR FAMILY'S VACCINATIONS
Use the ImmunizeCA app to:
• Keep track of your family's vaccinations
• Receive appointment reminders
• Find out when your next vaccine is due
• Get alerts of outbreaks near you
GET THE APP:
Download on the App Store
GET IT ON Google play
Public Health Agency of Canada
Agence de la santé publique du Canada
CPHA•ACSP
immunize Canada

Invasive serogroup W *Neisseria meningitidis* (MenW) in Ontario, Canada shows potential clonal replacement during the period January 1, 2009 – June 30, 2016

Tsang RSW[1]*, Deeks SL[2,3], Wong K[2], Marchand-Austin A[2], Jamieson FB[2,3]*

Affiliations

[1] National Microbiology Laboratory, Public Health Agency of Canada, Winnipeg, MB

[2] Public Health Ontario, Toronto, ON

[3] University of Toronto, Toronto, ON

***Correspondence:** raymond.tsang@phac-aspc.gc.ca, frances.jamieson@oahpp.ca

Abstract

Background: In Ontario, serogroup W *Neisseria meningitidis* (MenW) accounts for a small percentage of all invasive meningococcal disease (IMD) and between 2010 and 2014, only zero to three confirmed cases occurred per year. However, between August 2015 and June 2016, six culture confirmed MenW IMD cases were reported in Ontario.

Objective: All MenW IMD cases in Ontario between January 1, 2009 and June 30, 2016 were reviewed and the *N. meningitidis* strains involved were characterized.

Methods: MenW cases were identified in the Integrated Public Health Information System by Public Health Ontario. MenW isolates were characterized at the National Microbiology Laboratory.

Results: Of the thirteen MenW IMD cases, six were due to isolates typed as sequence type (ST)-22 clonal complex (cc), six were of ST-11 cc, and one ST-167 cc. Most (83%) MenW cases due to the ST-22 cc occurred prior to 2012 while all six MenW cases due to ST-11 cc happened since May 2014. The six MenW ST-11 isolates appeared to be clonal.

Conclusion: It appears that a genetic shift in the invasive MenW isolates has occurred in Ontario in 2014 with the ST-11 clone replacing the traditional ST-22 clone.

Suggested citation: Tsang RSW, Deeks SL, Wong K, Marchand-Austin A, Jamieson FB. Invasive serogroup W *Neisseria meningitidis* (MenW) in Ontario, Canada shows potential clonal replacement during the period January 1, 2009 to June 30, 2016. Can Comm Dis Rep. 2016;42(12):263-6.

Introduction

Invasive meningococcal disease (IMD) is caused by the strict human pathogen *Neisseria meningitidis*, which may cause severe invasive disease in susceptible individuals including meningitis, septicemia, bacteremic pneumonia, septic arthritis or pericarditis. Almost all invasive isolates of *N. meningitidis* are encapsulated, and the capsule is the basis of the serogrouping antigen and the protective vaccine for serogroups A, C, W (or formerly W135), and Y (1). Currently 12 different serogroups of meningococci are recognized but most infections are caused by serogroups A, B, C, W, X and Y (2,3).

According to historical data, serogroup A *N. meningitidis* (MenA) was the most commonly isolated meningococci in Canada in 1971 and 1972 (4). Since then, the prevalence of MenA has declined and by the mid-1990s, MenA only accounted for 1% or less of the IMD cases in Canada (5). Now, MenA is no longer endemic in Canada. Currently, most IMD cases are caused by serogroup B (MenB) and serogroup Y (MenY) (6), especially after MenC conjugate vaccine was incorporated into publicly-funded childhood immunization programs across the country in the early to mid-2000s (7). In Ontario, MenC conjugate vaccine was introduced at 12 months of age and for grade seven students in 2004/05. In 2009, quadrivalent meningococcal conjugate vaccine (A,C,Y,W) replaced MenC vaccine for grade seven students.

From 2006 to 2011, serogroup W (MenW) *N. meningitidis* accounted for only 5.7% (62 out of 1,092 isolates) of all invasive meningococci isolated in Canada (6). In the province of Ontario, between 2010 and 2014, there were only zero to three culture confirmed MenW IMD cases per year. However, between August 2015 and June 2016, six culture confirmed MenW IMD cases were reported; five appeared to be due to the same strain typed as W:2a:P1.2,(5) sequence type (ST)-11. The objective of this study was to review all MenW IMD case isolates received at the National Microbiology Laboratory (NML) from the province of Ontario between January 1, 2009 and June 30, 2016.

Materials and methods

IMD is a reportable disease in Ontario and data regarding cases are captured in the provincial reportable disease database and

the Integrated Public Health Information System (iPHIS) (8). The Public Health Ontario (PHO) laboratory routinely receives all IMD case isolates through its regional laboratories and/or community hospitals. Isolates received were confirmed as *N. meningitidis* using standard biochemical tests and serogrouped using bacterial agglutination method and antisera provided by the NML. Isolates were also forwarded to the NML for serotyping, serosubtyping, PorA genotyping and multi-locus sequence typing (MLST) (9). Isolates in the electrophoretic type (ET)-37 or ST-11 clonal complex (cc) were further subdivided into the ET-15 and the ET-37 (not ET-15) types by extending the DNA sequencing of their *fumC* genes to identify the molecular signatures for differentiating these ET types (10).

This study included MenW isolates received from Ontario at the NML between January 1, 2009 and June 30, 2016. The list of isolates was verified by PHO against cases reported to iPHIS during the same time period to ensure completeness. Age and sex of the cases were obtained from the specimen requisition forms.

Results

Thirteen MenW IMD case isolates from the province of Ontario were identified between January 1, 2009 and June 30, 2016 (**Table 1**). The 13 individuals included six females and seven males between 15 months and 86 years of age, with a median age of 53.4 years. The majority of cases were adults (77%), and of these, most were older adults. Only three cases occurred in children and all were two years of age and younger. None of the 13 cases had a fatal outcome. Blood culture was the most common specimen source (85%). Six of the cases occurred during the winter months of December to March while the rest occurred from April to September. As these cases were caused by a vaccine preventable serogroup, public health management would include chemoprophylaxis and immunoprophylaxis with quadrivalent meningococcal vaccine for close contacts (11).

Table 1: Microbiological characteristics of invasive serogroup W *Neisseria meningitidis* isolated in the province of Ontario from invasive meningococcal disease cases between the period January 1, 2009 and June 30, 2016

Case No.	Age/sex	Specimen source	Culture isolation date	Culture's Antigenic formula	PorA genotype	MLST ST	Clonal complex
1[*]	86/F	shoulder fluid	Dec. 2008	W:NT:P1.6	P1.18-1,3,38	ST-22	ST-22
2	2/F	CSF	Feb. 2009	W:NT:P1.6	P1.18-1,3,38	ST-8230	ST-22
3	15 months/F	Blood	May 2010	W:NT:P1.-	P1.18-1,3,38	ST-8974	ST-22
4	82/F	Blood	Feb. 2011	W:NT:P1.-	P1.19,15,36	ST-22	ST-22
5[†]	1/M	Blood	April 2011	W:NT:P1.-	*porA* gene deletion	ST-184	ST-22
6	78/M	Blood	Mar. 2011	W:19:P1.5	P1.5-1,10-4,36-2	ST-3705	ST-167
7	53/F	Blood	May 2014	W:2a:P1.5,2	P1.5,2,36-2	ST-10826	ST-10826 ST-11
8	53/F	Blood	Aug. 2015	W:2a:P1.5,2	P1.5,2,36-2	ST-11	ST-11
9	66/M	Blood	Sept. 2015	W:2a:P1.5,2	P1.5,2,36-2	ST-11	ST-11
10	36/M	Blood	Dec. 2015	W:NT:P1.16	P1.18-1,16,37-1	ST-184	ST-22
11	60/M	Blood	Mar. 2016	W:2a:P1.2	P1.5,2,36-2	ST-11	ST-11
12	83/M	Blood	June 2016	W:2a:P1.2	P1.5,2,36-2	ST-11	ST-11
13	27/M	Blood	June 2016	W:2a:P1.2	P1.5,2,36-2	ST-11	ST-11

Abbreviations: PorA, class 1 outer membrane protein (P1.) variable regions 1,2, and 3 (denoted by numbers separated by commas); MLST, multi-locus sequence typing; ST, Sequence Type; F, female; M, male; NT, nontypeable; P1.- = non-serosubtypeable; CSF, cerebrospinal fluid. No., Number

[*] Although this case was identified in 2008, the isolate was received at the National Microbiology Laboratory in January 2009 and therefore, it was included in this study

[†] This case occurred in an Ontario resident but hospitalized in Manitoba and the case isolate was analyzed at the National Microbiology Laboratory

Five of the cases were caused by strains expressing the serotype antigen 2a with PorA genotype of P1.5,2,36-2 and typed by MLST as ST-11, a member of the ST-11 cc. Another serotype 2a MenW strain with PorA genotype of P1.5,2,36-2 was identified as ST-10826, a single locus variant (SLV) of ST-11, and therefore, also a member of the ST-11 cc. These six cases all occurred since May 2014, were in adults and four were male. Evidence that the six W:2a:P1.2,(5) ST-11 isolates were clonal included the lack of the characteristic *fumC* gene mutation that characterized them as ET-37 and not ET-15. None of the cases reported travel to the Hajj.

Six MenW case isolates belonged to ST-22 cc and presented as four different STs (two each of ST-22 and ST-184; and one each of ST-8230 and ST-8974). In addition, these six MenW isolates were also heterogeneous in terms of their antigenic formulas and PorA genotypes (Table 1). Five of the six (83%) MenW isolates belonging to the ST-22 cc occurred prior to 2012 and half were young children. The remaining MenW isolate was typed as ST3705, a member of the ST-167 cc commonly associated with MenY according to the Neisseria.org MLST website (12).

Discussion

This laboratory-based surveillance report captured the emergence or re-emergence of the MenW strain expressing serotype antigen 2a and serosubtype antigens of P1.2 or P1.5,2 with PorA genotype of P1.5,2,36-2 and belonging to the ST-11 cc. This clone seems to have emerged and displaced the traditional MenW clone of W:NT:P1.6 that belonged to the ST-22 cc since May 2014 (authors' unpublished data). Through genotypic and phenotypic analysis, ST-11 MenW 2a:P1.5,2 was first identified in Canada in 1970 (13). Prior to the spring of 2000, ST-11 MenW has only caused sporadic disease. However, the first large MenW outbreak involving >400 cases from 16 countries due to a ST-11 cc strain was reported among the pilgrims attending the Hajj in Mecca in year 2000 (13,14). Subsequent sporadic cases were thought to be due to pilgrims returning from the Hajj and transmitting the infection to their close contacts, as have been reported in Europe (15). This clone has since spread to sub-Saharan Africa (16) and South America (17,18). However, beginning in 2010, several countries have reported an increase in IMD due to ST-11 MenW (19-22). Unusual clinical presentation of MenW IMD due to this clone has been reported and the possibility of endemic local transmission has also been suggested (23,24). The finding of six MenW cases associated with the ST-11 cc in Ontario since May 2014 was unusual, especially as none have reported any travel to the Hajj or exposure to individuals returning from the Hajj.

The majority (10 out of 13) of MenW cases in Ontario occurred in adults, particularly older adults. While all ST-11 cases occurred in adults, the ST-22 cases occurred in either very young children or adults (Table 1). This was in contrast to the findings reported from South America with most MenW:2a ST-11 cases occurring in young children. For example, in Argentina, 63% of MenW:2a ST-11 cases were in children less than nine years old (18); in

Chile, 47% of cases were in children less than five years old (25); while in Brazil, the average age was 15 years (26). In England and Wales, the increase in disease due to the ST-11 MenW strain was noticed in all age groups (24,27). As there have been only six cases reported in Ontario, it is too early to note whether this age pattern has any epidemiological significance.

The ST-11 *N. meningitidis* cc has been known as a hypervirulent clone with the potential to cause epidemics. The first documentation of the ST-11 meningococci causing an epidemic was in the 1960s in the US Army (28,29). ST-11 meningococci may be found in strains with serogroup antigens of B, C, W and Y (30). The most significant IMD event in Canada was due to an ST-11 cc MenC strain typed as ET-15, a genetic variant within the ST-11 cc of *N. meningitidis* (31). This clone first emerged in the province of Ontario in 1986 (31) and caused a localized outbreak in January 1989. By 1990 it had spread throughout the province. This clone was also responsible for the increase in MenC disease in the U.S., causing several outbreaks other than spreading to other provinces within Canada (32). The global spread of this ET-15 clone leading to outbreaks in multiple countries has been described (33). Although sporadic cases of ET-15 MenB have been observed in Canada (probably through capsule switching), such strains failed to establish sufficiently to cause any sustained disease in Canada (34). MenY ST-11 has not been observed in Canada (authors' unpublished observation). Although others have discussed the potential relationship between the ST-11 MenC and the ST-11 MenW through capsule switching (13), the finding of sporadic MenW (and/or MenC) ST-11 isolates as far back as 1970 has made it impossible to determine if any such capsule switching event had occurred.

The potential unusual clinical presentation due to MenW ST-11 that others have reported (23) along with possible endemic spread (24) without direct or indirect travel history (through exposure to travellers) and age range of cases reported in Ontario should alert clinicians to remain vigilant and consider a diagnosis of IMD in all age groups. This short surveillance report serves to inform the public health and clinical community of the possible emergence of a ST-11 MenW strain in Ontario, which needs to be monitored.

Acknowledgements

We thank Dennis Law, Jianwei Zhou and Saul Deng for providing laboratory assistance in the analysis of strains, and the NML's DNA Core Service for providing assistance in nucleotide sequencing. We also thank Deirdre Soares and the Public Health Ontario Laboratory Reference Identification Section staff.

Conflict of interest

None.

Funding

This publication made use of the Neisseria Multi Locus Sequence Typing website (http://pubmlst.org/neisseria/) developed by Keith Jolley and sited at the University of Oxford (Jolley & Maiden 2010, BMC Bioinformatics, 11:595; http://bmcbioinformatics.biomedcentral.com/articles/10.1186/1471-2105-11-595). The development of this site has been funded by the Wellcome Trust and European Union.

References

1. Rosenstein NE, Perkins BA, Stephens DS, Popovic T, Huges JM. Meningococcal disease. N Engl J Med. 2001 May; 344:1378-1388.
2. Apicella M. *Neisseria meningitides*. In Mandell G, Bennett JE, Dolin R, eds. Mandell, Douglas and Bennett's principles and practice of infectious diseases, 7th edition. Philadelphia, PA: Churchill Livingstone Elsevier; 2009. p. 2737-52.
3. Harrison LH, Trotter CL, Ramsay ME. Global epidemiology of meningococcal disease. Vaccine. 2009;27S:B51-B63.
4. Varughese PV, Carter AO. Meningococcal disease in Canada, surveillance summary to 1987. Can Dis Wkly Rep. 1989;15:89-96.
5. Deeks SL, Kertesz D, Johnson W, Ashton F. Surveillance of invasive meningococcal disease in Canada, 1995-1996. Can Comm Dis Rep. 1997;23(16):121-5.
6. Li YA, Tsang R, Desai S, Deehan H. Enhanced surveillance of invasive meningococcal disease in Canada, 2006-2011. Can Comm Dis Rep. 2014;40(9):160-9.
7. Government of Canada [Internet]. Immunization schedule tool. [updated 2015 June 25; cited 2016 Sep 29]. Ottawa: Government of Canada; 2015. Available from: http://healthycanadians.gc.ca/apps/schedule-calendrier/index-eng.php.
8. Government of Ontario [Internet]. The Integrated Public Health Information System of Public Health Ontario. Ottawa: Public Health Ontario; 2014. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/meningococcal_cd.pdf.
9. Jamieson FB, Rawte P, Deeks SL, Zhou J, Law DKS, Deng S, et al. Genetic and antigenic characterization of invasive endemic seroroup B *Neisseria meningitidis* from Ontario, Canada, in 2001-2010. J Med Microbiol. 2013;62:46-55.
10. Vogel U, Claus H, Frosch M. Molecular basis for distinction of the ET-15 clone within the ET-37 complex of *Neisseria meningitidis*. J Clin Microbiol. 2000;38:941-2.
11. Government of Ontario. Ministry of Health and Long-Term Care [Internet]. Infectious diseases protocol, 2014. Appendix A: Disease specific chapters. Chapter: Meningococcal disease, invasive. [updated 2014 Jan; cited 2016 Sep 29]. Toronto, ON: Queen's Printer for Ontario; 2015. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/meningococcal_chapter.pdf.

12. PubMLST [Internet]. Neisseria sequence typing home page. [cited 2016 Sep 29]. Available from: http://pubmlst.org/neisseria/.
13. Mayer LW, Reeves MW, Al-Hamdan N, Sacchi CT, Taha MK, Ajelllo GW, et al. Outbreak of W135 meningococcal disease in 2000: Not emergence of a new W135 strain but clonal expansion within the electrophoretic type -37 complex. J Infect Dis. 2002 June;185:1596-1605.
14. Taha MK, Achtman M, Alonso JM, Greenwood B, Ramsay M, Fox A, et al. Serogroup W135 meningococcal disease in Hajj pilgrims. Lancet. 2000 Dec;356(9248):2159.
15. Aguilera JF, Perrocheau A, Meffre C, Hahne S and the W135 Working Group. Outbreak of serogroup W135 meningococcal disease after the Hajj pilgrimage, Europe, 2000. Emerg Infect Dis. 2002 Aug;8(8):761-767.
16. du Chatelet IP, Traore Y, Gessner BD, Antignac A, Naccro B, Njanpop-Lafourcade BM, et al. Bacterial meningitis in Burkina Faso: Surveillance using field-based polymerase chain reaction testing. Clin Infect Dis. 2005 Jan;40:17-25.
17. Weidlich L, Baethgen LF, Mayer LW, Moraes C, Klein CC, Nunes LS, et al. High prevalence of *Neisseria meningitidis* hypervirulent lineages and emergence of W135:P1.5,2:ST-11 clone in Southern Brazil. J Infect. 2008;57:324-31.
18. Efron AM, Salcedo C, Regueira M, Vazquez JA. W135 invasive meningococcal strains spreading in South America: Significant increase in incidence rate in Argentina. J Clin Microbiol. 2009 Jun;47(6):1979-80.
19. Collard JM, Maman Z, Yacouba H, Djibo S, Nicolas P, Jusot, JF, et al. Increase in *Neisseria meningitidis* serogroup W135, Niger, 2012. Emerg Infect Dis. 2010 Sep;16(9):1496-8.
20. Hossain MJ, Roca A, Mackenzie GA, Jasseh M, Hossain MI, Muhammad S, et al. Serogroup W135 meningococcal disease, The Gambia, 2012. Emerg Infect Dis. 2013 Sep;19(9):1507-10.
21. Zhou H, Liu W, Xu L, Deng L, Deng Q, Zhuo J, et al. Spread of *Neisseria meningitidis* serogroup W clone, China. Emerg Infect Dis. 2013 Sep;19(9):1496-9.
22. Hu S, Zhang W, Li F, Hu Z, Ma E, Zheng T, et al. *Neisseria meningitidis* serogroup W135 sequence type 11, Anhui Province, China, 2011-2013. Emerg Infect Dis. 2014 Jul;20(7):1236-8.
23. Vienne P, Ducos-Galand M, Guiyoule A, Pires R, Giorgini D, Taha MK, et al. The role of particular strains of *Neisseria meningitidis* in meningococcal arthritis, pericarditis, and pneumonia. Clin Infect Dis. 2003 Dec;37:1639-42.
24. Ladhani SN, Beebeejaun K, Lucidarme J, Campbell H, Gray S, Kaczmarski E, et al. Increase in endemic *Neisseria meningitidis* capsular group W sequence type 11 complex associated with severe invasive disease in England and Wales. Clin Infect Dis. 2015;578-85.
25. Valenzuela MT, Moreno G, Vaquero A, et al. Emergence of W135 meningococcal serogroup in Chile during 2012 [in Spanish]. Rev Med Chile. 2013;141 959-67.
26. Barroso DE, Castineires TMPP, Cabral AC, Vicente ACP, Robelo MC, Cerqueira EO, Tulenkoo MM, Marsh JW, Krauland MG, Harrison LH. *Neisseria meningitidis* ST-11 clonal complex bearing capsule serogroups B, C, or W in Brazil. J Infection. 2013 Jun;(6):547-50.
27. Bethea J, Makki S, Gray S, MacGregor V, Ladhani S. Clinical characteristics and public health management of invasive meningococcal group W disease in the East Midlands region of England, United Kingdom, 2011 to 2013. EuroSurveillance. 2016 Jun;21(24).
28. Brundage JF, Zollinger WD. Evolution of meningococcal disease: Epidemiology in the US Army. In Vedros NA (ed). Evolution of meningococcal disease. Boca Raton, FL: CRC Press Inc.; 1987. Vol. 1, p. 99-119.
29. Wang JF, Caugant DA, Morelli G, Koumare B, Achtman M. Antigenic and epidemiologic properties of the ET-37 complex of *Neisseria meningitidis*. J Infect Dis. 1993 Jun;167:1320-9.
30. Caugant DA. Population genetics and molecular epidemiology of *Neisseria meningitidis*. APMIS. 1998;106:505-25.
31. Ashton F, Ryan JA, Borczyk A, Caugant DA, Mancino L, Huang D, et al. Emergence of a virulent clone of *Neisseria meningitidis* serotype 2a that is associated with meningococcal group C disease in Canada. J Clin Microbiol. 1991 Nov;29(11):2489-93.
32. Jackson LA, Schuchat A, Reeves MW, Wenger JD. Serogroup C meningococcal outbreaks in the United States. An emerging threat. JAMA. 1995 Feb;273(5):383-9.
33. Jelfs J, Munro R, Ashton FE, Caugant DA. Genetic characterization of a new variant within the ET-37 complex of *Neisseria meningitidis* associated with outbreaks in various parts of the world. Epidemiol Infect. 2000;125:285-98.
34. Kertesz DA, Coulthart MB, Ryan JA, Johnson WM, Ashton FE. Serogroup B electrophoretic type 15 *Neisseria meningitidis* in Canada. J Infect Dis. 1998 Jun;177(6):1754-7.

Preparedness for Zika Virus Disease — New York City, 2016

Source: Madad SS, Masci J, Cagliuso NV Sr., Allen M. Preparedness for Zika Virus Disease — New York City, 2016. Morb Mortal Wkly Rep 2016;65:1161–1165. DOI: http://dx.doi.org/10.15585/mmwr.mm6542a2.

The state of New York has reported the highest number of Zika virus disease cases in the continental United States, with 715 cases reported as of September 21, 2016, underscoring the importance of the health care system to be prepared to care for patients with possible Zika virus disease. NYC Health + Hospitals created a Zika Preparedness and Response Action Plan by building upon the framework established in 2014 to screen patients for possible exposure to Ebola virus disease. The Zika plan includes universal screening for travel-associated Zika virus exposure, signage and maps depicting areas with active Zika virus transmission, laboratory services, and timely linking of infected patients to appropriate care. A robust emergency preparedness and response program can help health care systems limit the effects of Zika virus and ensure appropriate screening, diagnosis, and care. Potentially effective strategies include modification of established and tested protocols, offering ongoing health care provider education, and close collaboration with state and local health departments for Zika guidance and support.

Candida auris, a globally emerging invasive, multidrug-resistant fungus

Source: Vallabhaneni S, Kallen A, Tsay S, Chow N, Welsh R, Kerins J, Kemble SK et al. Investigation of the first seven reported cases of Candida auris, a globally emerging invasive, multidrug-resistant fungus — United States, May 2013–August 2016 Morb Mort Weekly Report. Early Release / November 4, 2016 / 65. https://www.cdc.gov/mmwr/volumes/65/wr/mm6544e1.htm?s_cid=mm6544e1_e.

Summary

What is already known about this topic?

Candida auris is an emerging pathogenic fungus that has been reported from at least a dozen countries on four continents during 2009–2015. The organism is difficult to identify using traditional biochemical methods, some isolates have been found to be resistant to all three major classes of antifungal medications, and *C. auris* has caused health care–associated outbreaks.

What is added by this report?

This is the first description of *C. auris* cases in the United States (US). *C. auris* appears to have emerged in the US only in the last few years, and US isolates are related to isolates from South America and South Asia. Evidence from US case investigations suggests likely transmission of the organism in health care settings.

What are the implications for public health practice?

It is important that laboratories accurately identify *C. auris* and for health care facilities to implement recommended infection control practices to prevent the spread of *C. auris*. (In the US): Local and state health departments and CDC should be notified of possible cases of *C. auris* and of isolates of *C. haemulonii* and *Candida* spp. that cannot be identified after routine testing.

Thank you to the CCDR peer reviewers of 2016

Many thanks to the following people for the time and expertise they have given to the *Canada Communicable Disease Report* (CCDR) as peer reviewers in 2016. These individuals have worked anonymously, in their spare time, with no remuneration. Their comments and insights have been vital to enhancing the quality of articles published in CCDR that publishes practical and authoritative information for clinicians and public health professionals in Canada and internationally.

Natalia Abraham
Marina Afanasyeva
Anton P Andonov
Alain Aspirault
Oliver Baclic
Geri Bailey
Erika Bontovics
James Brooks
Richard B Chipman
Alixanderia Clymans
Andrea Currie
Michel Deilgat
Shalini Desai
Catherine Dickson
Shawn Donaldson
Mike Drebot
Colleen Dudar
Paul Eagan
Christine Fehlner-Gardiner
Catherine Filejski
Rita Finley
Anne Fortin
Sarah Funnell
Anne Gabriel
Jennifer Geduld
Robert Geneau
Brian Gottheil
Judy D Greig
Shalane Ha
Lisa Hansen
Althea House
Mohamed Karmali
Siobhan Kearns
Chris Kuntz
Beth Jackson
Julie A Laroche
Patrick Leighton
Donald Lein
Robert Lerch
Lee Lior
Maurica Maher
Pascal Michel
Nick Ogden
Toju Ogunremi
Elspeth Payne
Melissa Phypers
Carolyn Pim
Robert Pless
Pierre Plourde
Lisa Pogany
Nick Previsich
Joss Reimer
Hilary Robinson
Sean Rourke
Erling Rud
Patricia Salsbury
Marina Salvadori
Dena Schanzer
Lee Smith-Powell
Lisa Smylie
Candace Smith
Courtney R Smith
Rob Stirling
Sylvia Thompson-Nicholson
Lidiya Tsegaye
Paul Varughese
Linda Vrbova

and any others who we may have inadvertently missed.

CCDR

CANADA COMMUNICABLE DISEASE REPORT

Public Health Agency of Canada
130 Colonnade Road
Address Locator 6503B
Ottawa, Ontario K1A 0K9
ccdr-rmtc@phac-aspc.gc.ca

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

Published by authority of the Minister of Health.

© Her Majesty the Queen in Right of Canada, represented by the Minister of Health, 2016

This publication is also available online at

http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/16vol42/index-eng.php

Également disponible en français sous le titre :
Relevé des maladies transmissibles au Canada